Government of the District of Columbia
Department of Health
Environmental Health Administration

THE DISTRICT OF COLUMBIA
2004
NUTRIENT AND SEDIMENT
TRIBUTARY STRATEGY

June 2004

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BMP	Best Management Practice
BNR	Biological Nitrogen Removal
BOD	Biochemical Oxygen Demand
C2K	Chesapeake 2000 Agreement
CIP	Capital Improvement Plan
Chl a	Chlorophyll-a
CBP	Chesapeake Bay Program
CSS	Combined Sewer System
CSO	Combined Sewer Overflow
CVA	Clean Vessel Act
CWA	Clean Water Act
DC DCRA	District of Columbia Department of Consumer & Regulatory Affairs
DC DOH	District of Columbia Department of Health
DC DOT	District of Columbia Department of Transportation
DCMR	District of Columbia Municipal Regulations
DC WASA	District of Columbia Water and Sewer Authority
EHA	Environmental Health Administration
ICPRB	Interstate Commission on the Potomac Basin
IMA	Inter-Municipal Agreement
LID	Low Impact Development
LTCP	Long Term Control Plan
mgd	million gallons per day
NM	Nutrient Management
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
PCBs	Polychlorinated Biphenyls
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
RFB	Riparian Forrest Buffer
SOP	Standard Operating Procedures
TN	Total Nitrogen
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
UFA	Urban Forestry Administration
WIP	Watershed Implementation Plans
WPD	Watershed Protection Division
WSM	Watershed Model
WTP	Water Treatment Plant
WQS	Water Quality Standards
WWTP	Waste Water Treatment Plant
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USNPS	United States National Park Service

EXECUTIVE SUMMARY

This report is the District of Columbia tributary strategy to reduce pollution of its waters, which are tributaries to the Chesapeake Bay, due to nutrients (nitrogen and phosphorus) and sediment. It was prepared by the Environmental Health Administration of the District of Columbia Department of Health (EHA), the District's lead agency on Chesapeake Bay restoration efforts. The strategy recognizes that the District has fulfilled the commitment made in the original Chesapeake Bay Agreement to reduce the controllable portion of these nutrients by 40% below 1985 levels and indicates how it plans to meet its new nutrient and sediment goals established by the Chesapeake Bay 2000 Agreement by 2010.

Because the District is substantially built out, EHA does not anticipate any difficulty in maintaining the reduced nutrients loadings achieved in recent years. This strategy indicates that the District will continue to maintain and build upon its nonpoint source management programs with a focus on solving its combined sewer overflow problems, better management of stormwater and the restoration of urban environmental assets.

The Chesapeake Bay 2000 Agreement establishes cap allocations for DC of 2.4 million pounds of nitrogen and 0.34 million pounds of phosphorus, and 6,000 tons of sediment per year. Blue Plains Wastewater Treatment Plant, located at the downstream end of District waters, is the largest point source of nutrients to District waters. CSOs and stormwater runoff from nonpoint sources contribute much less nutrients to its waters than does Blue Plains, yet these sources are the largest contributors of nutrient and sediment pollution to local waters overall.

The options to reduce nutrient and sediment loads to District waters in order for the District to maintain past progress and meet new allocation commitments include: upgrades to Blue Plains WWTP, implementation of the CSO Long-Term Control Plan (LTCP), and full implementation of urban BMPs in areas not served by the CSO. Each of the possible options is costly and has its own set of benefits and drawbacks in relation to improved water quality to District waters and the Chesapeake Bay. Local water quality is more greatly impacted by CSO/NPS rather than Blue Plains. Presented with a number of costly options to decrease nutrient and sediment pollution, the District of Columbia will focus first on those options that benefit its citizens by improving water and environmental quality within DC.

The District Tributary Strategy proposes to:

1. Fully implement the CSO LTCP in order to nearly eliminate combined sewer overflows into District waters.
2. Continue to maintain and optimize BNR at Blue Plains WWTP.
3. Remove 85 percent of incoming sediment from the Washington Aqueduct treatment train.

4. Fulfill MS4 permit requirements through continuation of the stormwater management regulatory program that requires BMP installation at new sites and which promotes retrofits and innovative techniques for older sites.
5. Implement watershed management plans that include wetland creation and stream restoration.
6. Continue public education programs to encourage citizens to reduce their own impacts.
7. Continue to reduce phosphorous loading below the cap-load allocation and explore options for nutrient trading.
8. Maintain progress towards Anacostia River restoration and delisting the District of Columbia waters from the 303(d) list.

Funding now is the biggest challenge. The District estimates the cost of implementing this strategy to be 4.2 billion dollars. The District cannot implement this strategy at present funding levels. Therefore, the city and interested stakeholders must continue to explore various funding options. This includes seeking out more federal funding where possible, first for the city's LTCP, for retrofitting the non-CSO areas of the city, and for Blue Plains WWTP upgrades.

PART I-BACKGROUND

A. Introduction

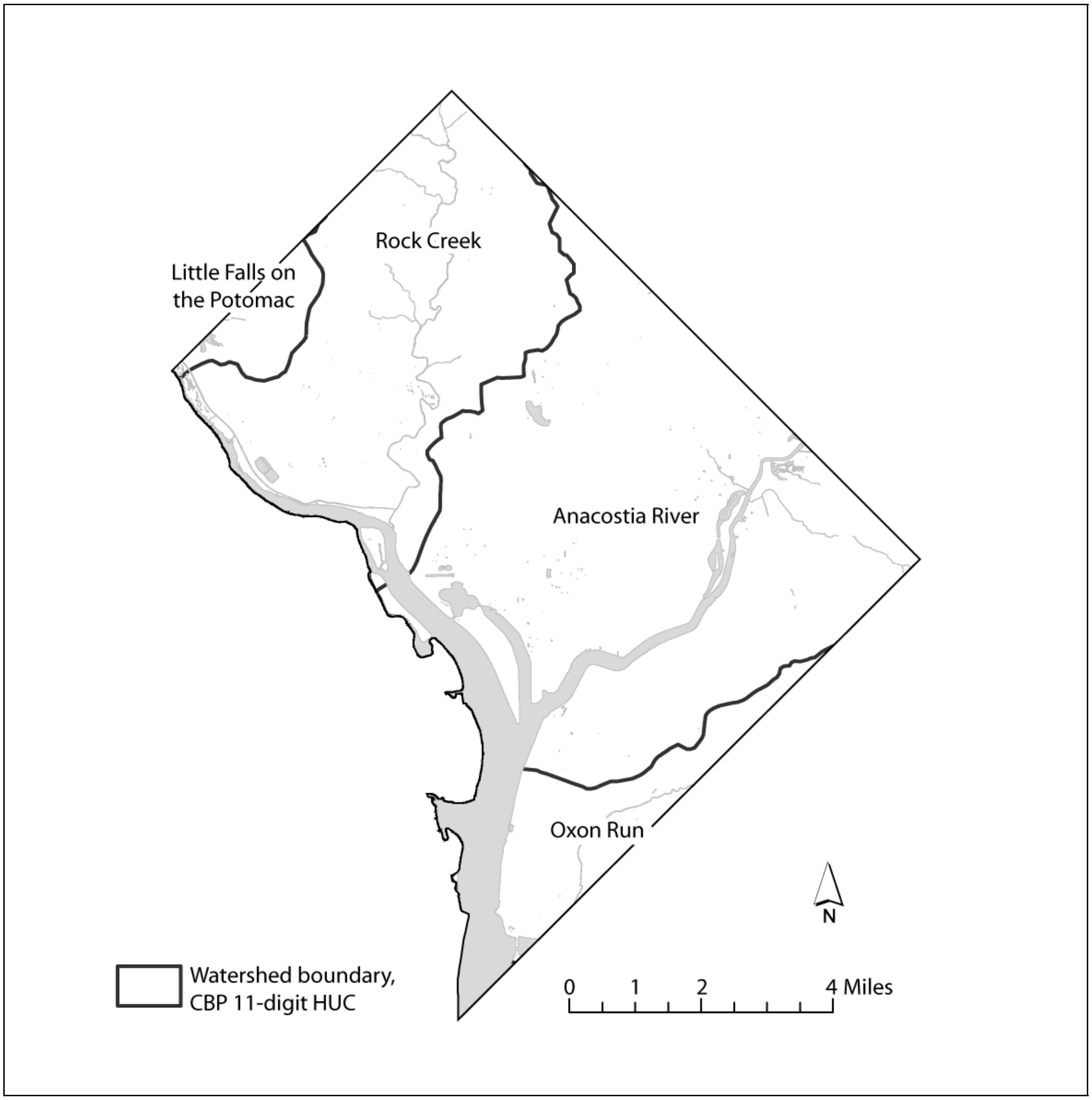
This document is the District of Columbia strategy to reduce pollution of its waters and the Chesapeake Bay caused by *nutrients and sediments*. It describes the main sources of nutrients and sediments, their impacts on the Bay and the District's water quality, and how the District of Columbia Government proposes to reach its nutrient and sediment pollution reduction goals by the year 2010. The District issued its first tributary strategy in November 1995. The 2004 Tributary Strategy summarizes accomplishments and provides and update on the District's approach to nutrient reduction. This Tributary Strategy has been written in response to new goals established by *Chesapeake 2000* (*C2K) Agreement,* the most recent regional compact designed to restore the Chesapeake Bay.

1. The District of Columbia Setting

The District of Columbia is a unique urban environment within the Chesapeake watershed, and the characteristics of that urban setting determine the sources and magnitude of nutrient and sediment pollution. The total area of the District is 69 square miles, compared to the 14,670 square-mile Potomac basin, and the 66,000 square-mile Chesapeake basin (see Figure 1)**.** The Potomac and Anacostia Rivers run through the District. The District comprises 80 percent developed land, 7 percent forest (park land), and 31 percent surface waters. Approximately 25 percent of the land is owned by the federal government. Unlike the other partners in the Chesapeake Bay Agreement, the District has no agricultural land, although over 40 percent of the nitrogen and phosphorus load to the Bay come from agricultural sources. Even so, District waters are affected by upstream agricultural runoff. The District is the center of the largest population concentration in the Potomac or Chesapeake watersheds. While the District's area is only 0.5 percent of the Potomac basin, it holds about 11 percent of the basin's population.

Three distinct sources of nutrients can be identified for the District of Columbia: point sources, nonpoint sources, combined sewer overflows (CSOs). Nutrients from point sources are those discharged at a single "point," primarily the Blue Plains Wastewater Treatment Plant. In contrast, nutrients from nonpoint or diffuse sources are those attributed to land uses and runoff, atmospheric deposition, or those generated by natural processes. CSOs may be considered a combination of the two. Although the majority of sediment to District waters comes from external, upstream sources, within the District sediment originates primarily from the nonpoint sources of land disturbance activities and stream bank erosion and from point source sediment basin discharges from the Dalecarlia Water Treatment Plant.

FIGURE 1: MAJOR WATERSHEDS WITHIN THE DISTRICT OF COLUMBIA



2. The Chesapeake Bay Agreement

In 1983, the first Chesapeake Bay Agreement was signed. The signatories (the District of Columbia; the states of Maryland, Pennsylvania, and Virginia; the U.S. Environmental Protection Agency (USEPA); and the Chesapeake Bay Commission) pledged to work together, through the Chesapeake Bay Program, to clean up the Bay. The District participates in the Bay Agreement because pollution in the Potomac River, the second largest tributary of the Bay, and the Anacostia River affects the Bay.

In 1987, the signatories amended the Bay Agreement to include specific goals for pollution control and established timetables to achieve these goals. One of those goals was to reduce the controllable portion (some nutrient runoff occurs naturally and is considered not controllable) of the nutrients nitrogen and phosphorus by 40 percent below 1985 levels by the year 2000. The District was given credit for its existing state-of-the-art phosphorus removal and only had to remove nitrogen by 40 percent. The signatories also agreed that these lower levels of controllable nutrients would be caps, levels not to be exceeded in future years.

Under *Chesapeake 2000*, the signatories pledged to take the next step in nutrient reduction by establishing revised nutrient goals, based on the Bay's water quality model, that are calibrated to the needs of living resources and our goals for their protection. Bay-wide nutrient reduction goals were established and jurisdiction-specific goals were set in March 2003 based on an allocation process agreed upon by signatories. Also, for the first time, a Bay-wide sediment goal with specific jurisdiction allocations was established to provide the water clarity necessary for underwater grasses to grow. New York, Delaware and West Virginia (headwater states) agreed to the same water quality commitments through a separate six-state memorandum of understanding with the USEPA. The signatories, including the headwater states, will next update their water quality standards relevant to the restoration of the Bay.

Chesapeake 2000 also designates the Anacostia River as a priority urban watershed along with Baltimore Harbor and the Elizabeth River. By 2010, the District of Columbia, working with its watershed partners (Maryland, Prince Georges and Montgomery Counties), will reduce pollution loads to the Anacostia in order to eliminate public health concerns. Restoration of the Anacostia River remains a high priority of the District of Columbia.

3. Collaboration

The District participates in numerous regional water quality protection efforts because it is part of several major watersheds that are the focus of regional organizations: the Chesapeake Bay watershed, the Potomac watershed, and the Anacostia watershed. In addition, the major point source of nutrients in the District's portion of the Potomac is Blue Plains Wastewater Treatment Facility, managed by the DC Water and Sewer Authority (DC WASA). WASA is a *regional* agency, serving the District, Maryland and Virginia. The District has worked closely with DC WASA over several years to address nutrient discharges, particularly nitrogen.

The D.C. Watershed Protection Division's Nonpoint Source Program works with several regional organizations such as the USEPA Chesapeake Bay Program, the Interstate Commission on the Potomac River Basin (ICPRB) and the Metropolitan Washington Council of Governments (MWCOG) to address shared environmental concerns. Some of the issues addressed with these organizations include toxics management, nutrient reduction, habitat restoration, best management practices, and combined sewer overflow.

<u>The Chesapeake Bay watershed</u>

The Chesapeake Bay Program, with representatives from Maryland, Virginia, Pennsylvania, the Chesapeake Bay Commission, the USEPA and the District of Columbia, coordinates and supports activities related to the Bay and its tributaries. The District's association with the Chesapeake Bay Program has resulted in coordination and development of the *Special Tributary Strategy for Federal Lands* in the District of Columbia, the *Anacostia River Toxics Management Action Plan*, the *Tributary Nutrient Reduction Strategy* and the *Biennial Workplan for the Anacostia River Watershed*.

<u>The Potomac River watershed</u>

Research in conjunction with the ICPRB has advanced District and regional understanding of the toxics problems of the District's waterways. The ICPRB, with commissioners that represent West Virginia, Virginia, Pennsylvania, Maryland, the Federal Government and the District of Columbia Government, works to protect, enhance and conserve the Potomac River and its tributaries.

<u>The Anacostia River watershed</u>

The Anacostia Watershed Restoration Committee comprises representatives from the USEPA, the State of Maryland, the counties of Prince Georges and Montgomery, USACOE, MWCOG, ICPRB and the District of Columbia. The Committee, managed by MWCOG, works to restore the Anacostia Watershed's water quality, wetlands, forest cover, ecological integrity, fish habitat and public participation. In addition to the committee, the effort to restore the watershed involves participation by about 60 organizations that include the US Fish and Wildlife Service, the US Department of Agriculture, US National Park Service, Washington Metropolitan Area Transit Authority, and Maryland-National Capital Parks and Planning Commission.

<u>Federal Agencies</u>

The federal government owns approximately 25 percent of the land area in the District of Columbia and is a key stakeholder in any effort to improve water quality. In August 1994, federal agencies signed a memorandum of understanding for control of pollution from federal facilities in the metropolitan Washington, D.C. area. The MOU also includes a pledge for the development of a nutrient reduction strategy for the federal facilities. When implemented, such a strategy will result in further reduction of nutrients from the federal facilities within the District and contribute to the goals of improving the quality of the Chesapeake Bay.

4. Procedural Considerations and Stakeholder Involvement

A draft of the 2004 Tributary Strategy was made available to the District's Soil and Water Conservation District representatives and its associated Citizen's Advisory Committee for review.

The draft strategy was made available to the public on April 30, 2004. Copies were also placed in the Martin Luther King Library. The Watershed Protection Division revised the strategy to reflect public opinion and finalized the document on June 30, 2004.

Copies of the District of Columbia Tributary Nutrient and Sediment Reduction Strategy can be obtained from the following address:

Watershed Protection Division
Bureau of Environmental Quality
Environmental Health Administration
Department of Health
District of Columbia Government
51 N Street, NE; 5th Floor
Washington, DC 20002

Sources for additional information about water quality in the District of Columbia, about the Chesapeake Bay program, and about the District's programs for reducing pollution are listed in the Bibliography**.**

B. Water Quality

1. Chesapeake Bay Water Quality

Chesapeake Bay water quality has experienced severe degradation over the past several decades, primarily the result of increased inputs of the nutrients nitrogen and phosphorus and sediment. The Bay is impaired for dissolved oxygen. Excess nutrient loads cause increased algae production and growth. Algae blooms send repercussions throughout the Bay ecosystem. Directly, excessive levels of algae restrict the amount of light reaching rooted aquatic plants, contributing to the decline of aquatic grasses. Additionally, when algae die, they decompose, robbing the water of life supporting dissolved oxygen needed by aquatic animals such fish and shellfish.

The Chesapeake Bay Program is starting to look more closely at the effect sediment load has on Bay water quality. Large sediment loads can smother Bay bottom-dwelling plants and animals. Suspended sediments also reduce the amount of light reaching Bay grasses. Additionally, sediments carry attached toxics and nutrients, increasing the Bay’s pollution.

The Chesapeake Bay Program tracks water quality by measuring nitrogen, phosphorus and dissolved oxygen levels throughout the Bay. Chlorophyll-a is also monitored as a measure of unhealthy algae growth. Because of its correlation to the health of aquatic grasses, the Bay Program also monitors water clarity by measuring the total amount of solids suspended (TSS) in the water and Secchi depth.

2. District of Columbia Water Quality

The District's water quality problems are characteristic of its highly urbanized landscape, which affect Rock Creek, the Potomac and Anacostia Rivers. Urban development inevitably results in the paving and building over of an increasing percentage of land area, progressively limiting the land's ability to absorb rainwater. This phenomenon is what makes stormwater such a large problem in urban settings, where the first downpour of a storm can wash a large amount of accumulated pollutants from impervious surfaces directly into surface water. Biological effects can be acute (fish kills) and chronic (lower diversity, loss of desirable species). Stream quality typically is impaired when urbanization accounts for 10 percent of a watershed, and a stream may be severely impaired when 25 percent of its watershed is impervious. The District estimated that 65 percent of its land area is covered by impervious surfaces (DC DCRA, 1988).

The District’s water quality problems are exacerbated by the city’s location just below the fall line where a significant amount of pollutants from upstream sources become caught up in the tidally influenced waters. This results in a pollution sink.

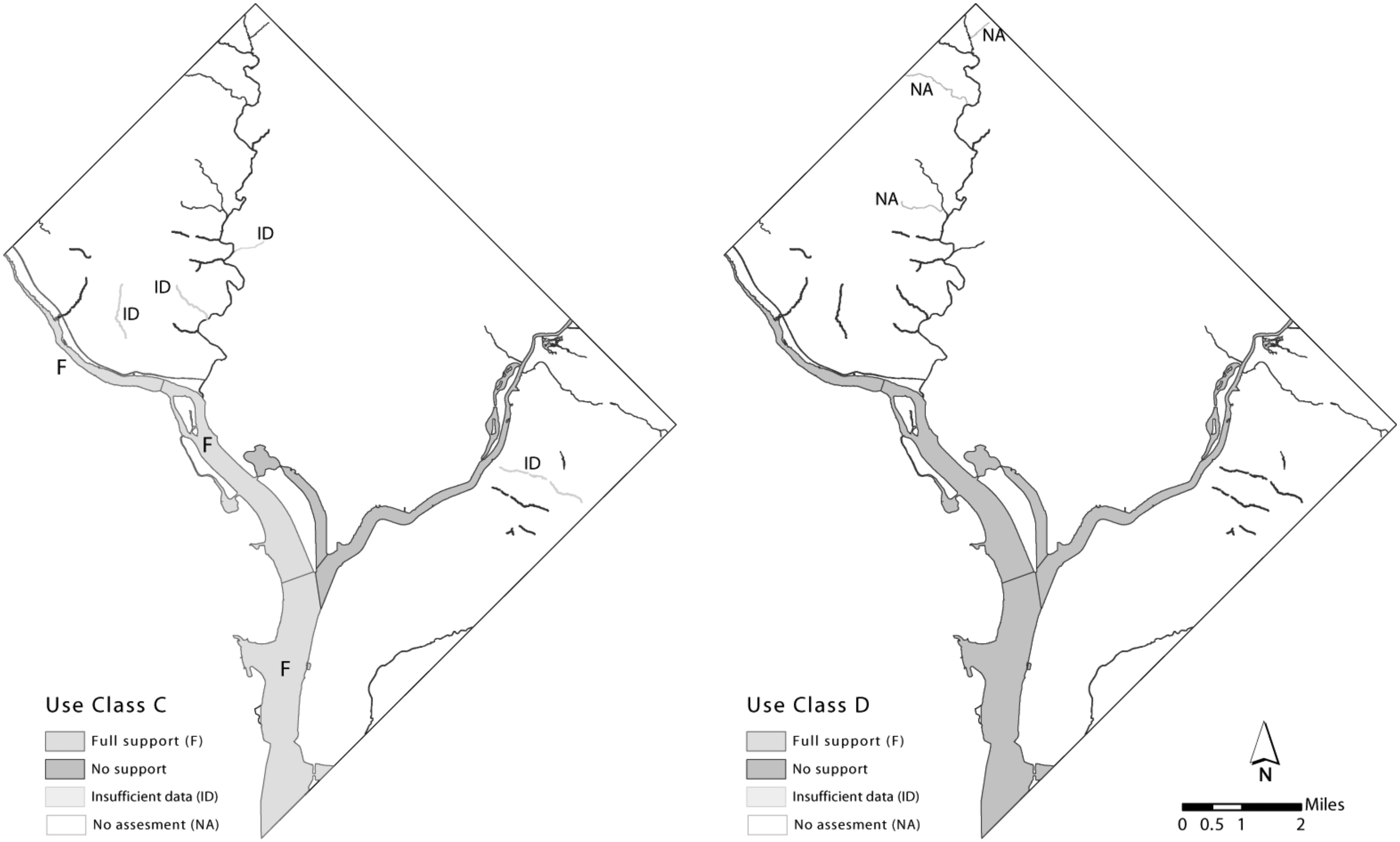
The regulatory tool for attaining and maintaining the quality of the District's waters is the Water Quality Standards (WQS). WQS regulations of the District of Columbia were promulgated under the District of Columbia Water Pollution Control Act (D.C. Law 5-188) and the Federal water pollution control law. In the WQS are designated uses of the District's waters, criteria for physical parameters to support those uses, and criteria limiting the concentrations of chemical components. The surface waters of the District are classified for five different designated uses:

A. primary contact recreation;
B. secondary contact recreation and aesthetic enjoyment;
C. protection and propagation of fish, shellfish and wildlife:
D. protection of human health related to consumption of fish and shellfish; and,
E. navigation.

The District of Columbia monitors water quality to assess whether or not its waters meet these designated uses and reports those finding to USEPA and Congress every other year, as required by the federal Clean Water Act. The 2002 Water Quality Report includes assessment of various types of water quality data collected during the period of 1999 to 2001. The evaluation found that the designated uses that directly relate to human use of the District’s waters were generally not supported (Figure 2). No water body monitored by the Water Quality Division fully supported all of its designated uses. Though some small improvements have been observed, the District of Columbia’s water quality continues to be impaired. The District does not have water quality standards specifically for nutrients, but nutrients contribute to water quality problems in the District by promoting excessive growth of algae that consumes oxygen when it decays.

FIGURES 2A, 2B: USE SUPPORT CLASS A PRIMARY CONTACT, AND CLASS B SECONDARY CONTACT.

FIGURES 2C, 2D: USE SUPPORT CLASS C AQUATIC LIFE USE, AND CLASS D TOXICS.



a. The Potomac River

The Potomac River is the largest water body in the District, comprising 12.5 miles of tidal river, and its water quality has continued to improve since 1992. It can be divided into three sections of varying water quality. All portions of the Potomac in the District now fully support protection of aquatic life. The two lower reaches now partially or fully support secondary contact recreation, which they did not in 1992. It is estimated that about 59 million pounds of nitrogen, 4.3 million pounds of phosphorus, and 4,060 million pounds of suspended sediment on average cross into the District each year (USGS 1998).

The segment from the Maryland border (above Chain Bridge) to the Key Bridge is historically the cleanest but still does not support most designated uses. For example, in 1992, this reach achieved the water quality level of partially supporting the use of primary recreation. The 2000 Water Quality Report indicates some degradation, however, since neither primary nor secondary recreation contact was even partially supported, due to elevated fecal coliform levels. Likely causes are increased urban runoff and combined sewer overflows. From the Key Bridge to Hains Point, the Potomac receives Rock Creek flow with its stormwater runoff and combined sewer overflows (CSOs). This section does not support use for primary contact recreation, but partially supports use for secondary contact recreation. From Hains Point to the Woodrow Wilson Bridge, the Potomac flows through heavily urbanized land, receiving stormwater runoff from streets and construction sites, as well as flow from the Anacostia River and Blue Plains. This segment has historically had the worst water quality of the three sections, but efforts to protect water quality are clearly paying off. This segment now fully supports use for secondary contact recreation and protection of aquatic wildlife.

In the 1960s and 1970s, the Potomac was subjected to severe algal blooms. The Potomac Estuary Model (Thomann & Fitzpatrick, 1982) was developed jointly by the District, USEPA, Maryland and Virginia to analyze the cause of the algal blooms. It was determined that removal of phosphorus from wastewater treatment plants was necessary and subsequently phosphorus removal was implemented. This has significantly improved the water quality of the tidal Potomac. Summer mean chlorophyll-<u>a</u> levels have decreased from about 100 μg/L in the 1960's and 1970's to 40 μg/L in the 1990's and the fish population index has increased to above 3.0.

b. The Anacostia River

The tidal Anacostia estuary drains a watershed of about 125 square miles, with an average flow of about 130 cfs (cubic feet per second) to the river. It is estimated that about 834,836 pounds of nitrogen and 117,880 pounds of phosphorus cross into the District each year (DC DOH 2001). The Anacostia has some of the poorest water quality recorded in the Chesapeake Bay system due to CSOs and nonpoint source pollution, primarily stormwater runoff. The urbanization of the Washington metropolitan area has caused profound alterations in the landscape over the past three centuries. The Anacostia Watershed has been particularly affected because the pollutants that enter the often-channelized headwater streams in Maryland and the District are quickly transported to the tidal river. Water stays in the tidal Anacostia, on average, about 44 days. Some areas tend to hold debris, nutrients, sediments and organic matter even longer. This poor flushing magnifies the degradation of water quality by pollution. Historical trends in land use, such as the loss of forest cover across the entire watershed and along the streams and rivers, and the loss of both tidal and non-tidal wetlands with their natural filtering capacity, are also important factors in the Anacostia watershed's present-day water quality problems. Seventy-eight percent of the Anacostia watershed within the District is now developed. The majority of these developments occurred before the promulgation of the District's stormwater management regulations. Because of the highly erodible soils upstream, sedimentation has been a significant problem in the Anacostia since the 1940s. The primary sources of high siltation are active surface mines and abandoned sand and gravel mines in Maryland as well as accelerated erosion of stream banks in the entire watershed. The highest nutrient concentrations in the District waters are found in the Anacostia. However, research (MWCOG, 1993) indicated that algal blooms might be limited in the District's portion of the Anacostia due to high turbidity in the District, which limits the amount of light available to support algal growth.

Water quality of the Anacostia estuary violates a number of standards. During the monitoring period covered by the 2000 Water Quality Report, the Anacostia did not support the use of either primary or secondary contact recreation because of fecal coliform violations. The Anacostia also has suffered from fish kills during summer months in past years. These occur when dissolved oxygen (DO) is depleted in the water by high levels of organic pollution. As a result of DO violations, the Anacostia only partially supports aquatic life uses in the upper reach, from the DC/Maryland line to the Pennsylvania Avenue Bridge. In the lower reach, the Anacostia fully supports aquatic life uses. CSOs and runoff from upstream portions of the watershed are the source of organic material. Due to high sedimentation rates and metal toxicity, the upper Anacostia supports no shellfish life. High polychlorinated biphenyls (PCBs) and chlordane concentrations led to a fish consumption advisory for several bottom dwelling fish in 1989 for both the Anacostia and the Potomac. The advisory is still in effect.

c. Rock Creek

The Rock Creek flows 9.3 miles within the District's borders, from the Maryland line to the Potomac River. It drains a watershed of about 77 square miles with an average discharge of about 75 cubic feet per second. Within the District, its course is almost exclusively through National Park Service land. Although the creek is lined with parkland, 70 percent of its watershed is developed. In addition to the runoff problems associated with this degree of development, the creek experiences frequent combined sewer overflows.

The Rock Creek receives flow from 29 combined sewers and 188 other outfalls, including District storm sewers, private properties' drains, and street storm sewers. Rock Creek also suffers from a combination of stressors by its tributary streams, including urban runoff and probable leakage from unidentified sewer lines crossing the streams. In addition, flooding, stream sedimentation, bank erosion, organic and chemical pollution, and littering are all significant nonpoint source problems. Urban runoff can cause prolonged and excessive periods of high suspended solids concentrations, turbidity, and bacterial contamination. Agricultural and urban runoff from outside the District also contribute significant pollution loads.

The Rock Creek geomorphology and land use presents problems for benthic (bottom dwelling) organisms, which are important because they are a food source for fish and other higher forms of life. Above the fall line, Rock Creek is sluggish, retaining pollutants. Below the fall line, uncontrollable runoff and faster flows cause excessive scour, i.e., erosion of the streambed. Both of these situations limit benthic habitat.

C. Sources of Nutrients

1. Chesapeake Bay

The sources of nutrients to the Bay are varied (see Figure 3). Nonpoint agricultural sources are the largest contributor. Point sources, such as wastewater treatment plants are estimated to be the second largest contributor. Urban runoff, the result of a watershed experiencing a surge in land development over the past three decades, is also an important contributor to the Bay's water quality problems.

FIGURE 3A: RELATIVE PERCENT LOADS TO THE BAY OF NITROGEN FROM MAJOR SOURCES AS DETERMINED BY THE WATERSHED MODEL, WSM 4.3

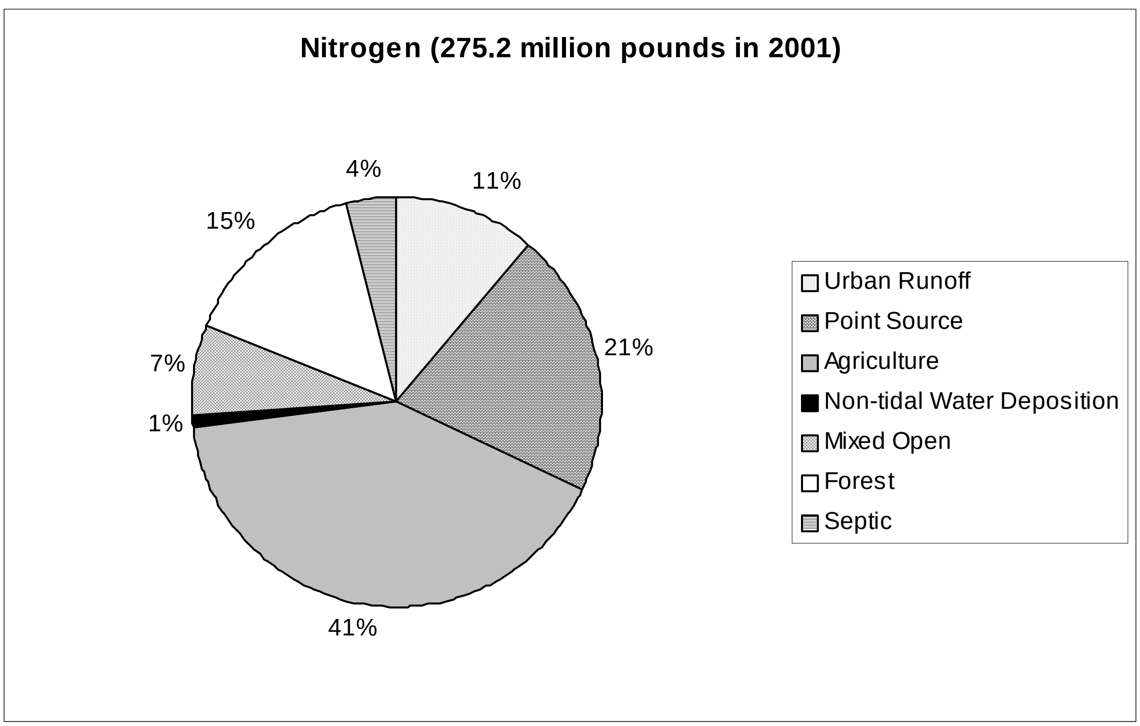
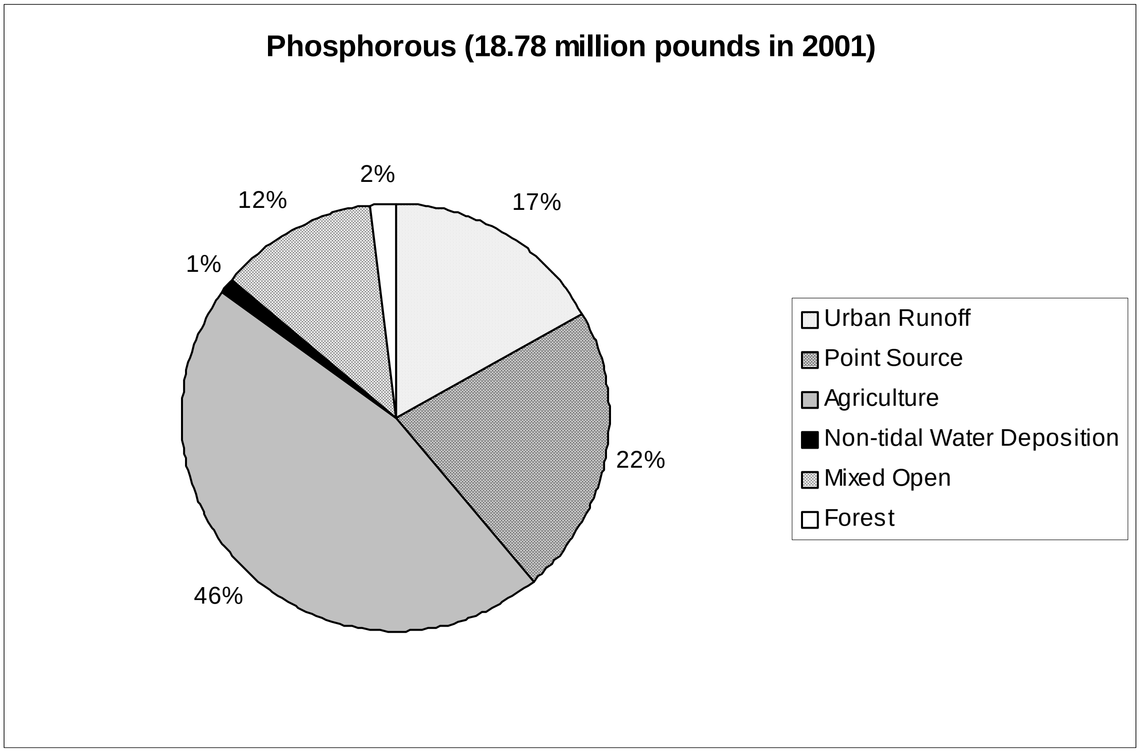


FIGURE 3B: RELATIVE PERCENT LOADS TO THE BAY OF PHOSPHOROUS FROM MAJOR SOURCES AS DETERMINED BY THE WATERSHED MODEL, WSM 4.3



2. External Sources

The geographic location of the District of Columbia, along with its small size, is such that its major watersheds originate outside its borders. As a result, the drainage from surrounding jurisdictions impacts the quality of District waters. The sources of these nutrients to the Potomac River from Maryland, Pennsylvania, and Virginia are nonpoint source runoff from agriculture and forests, and wastewater flows from towns. Additionally, urbanization of the immediate vicinity of the District, in Maryland and Virginia, also causes runoff of pollutants to the Anacostia and Potomac Rivers and Rock Creek. Because of its geography, the District must use a watershed approach to carry out its water pollution control activities. The District cannot do it alone.

3. D.C. Point Sources

While other permitted facilities contribute some nutrients, the largest permitted point source of nutrients in the District is municipal wastewater. All of the District's municipal wastewater is treated at the Blue Plains Wastewater Treatment Plant. Blue Plains is a regional wastewater treatment facility that receives wastewater from portions of Montgomery County and Prince George's County (Maryland), Fairfax County (Virginia), and all of the District of Columbia. It also receives wastewater from the Dulles International Airport. The treatment capacity of the facility is shared by these jurisdictions under the Inter-Municipal Agreement (IMA). The District of Columbia's share of Blue Plains flow is about 41 percent. The contribution of nutrients in the Blue

Plains discharge is distributed among the participating jurisdictions in accordance with the provisions of the IMA.

There are no major industrial dischargers of point source nutrient pollution in the District. Besides the Blue Plains facility, there are 16 NPDES permits issued to facilities for point source discharges to the District's waters. Of these, the Dalecarlia Water Treatment Plant (WTP), which periodically discharges accumulated sediments settled out from its treatment process also discharges nutrients, primarily phosphorus, attached to sediment particles.

<u>Overview of Blue Plains Wastewater Treatment Plant</u>

From its inception in 1938 until 1996, Blue Plains Wastewater Treatment Plant was managed by the District of Columbia Water and Sewer Utility Administration as a part of the DC government. In 1985, the Blue Plains users (District of Columbia, Fairfax County in Virginia, Montgomery and Prince George's Counties in Maryland, and the Washington Suburban Sanitary Commission) signed the Blue Plains Inter-municipal Agreement (IMA). This regional agreement was instrumental in providing an avenue of cooperation among the jurisdictions sharing the wastewater treatment plant. Issues addressed by the IMA included capacity allocations, structural changes, funding and long term management of the wastewater and sludge disposal. Under the terms of the IMA, the District operated Blue Plains so that it met the agreed flow capacity and effluent quality requirements.

That changed in 1996 when the District and the U.S. Government collaborated to create the DC Water Sewer Authority (DC WASA), a semiautonomous regional entity. All funding for operations, improvements and debt financing now comes through usage fees, EPA grants and the sale of revenue bonds. DC WASA's daily operations are controlled by a General Manager who reports to an 11-member board of Directors. Six of the board members represent the District and five represent the adjoining jurisdictions: two members each from Prince Georges and Montgomery counties in Maryland and one from Fairfax County in Virginia. Terms of the IMA continue to govern rates and other regional issues. DC WASA's Blue Plains Wastewater Treatment Plant, located in South West Washington, is the largest advanced wastewater treatment facility in the world.

4. D.C. Combined Sewer Overflows (CSOs)

The older part of the District, approximately one third of the city (see Figure 4), is served by a combined sewer system. The combined sewers carry both rainwater and domestic sewage. The system is designed so that during dry weather all the sanitary flow in the area served by combined sewers will go to the Blue Plains Regional Wastewater Treatment Plant (Blue Plains), where it is treated before being released into the Potomac River. When precipitation occurs, runoff from streets and open spaces also enters this sewer system. During small precipitation events, the flow from the combined sewer area is given primary treatment at Blue Plains. But during heavy rainfall, when the capacity of the conveyance system is exceeded, the excess flow, a mixture of rainwater and raw sewage, is discharged to surface waters. All of the District's streams are impacted by CSOs in varying degrees.

CSOs are not as significant a source of nutrients as Blue Plains. Key environmental concerns associated with CSOs are bacteria and BOD (biochemical oxygen demand). Nonetheless, as major system improvements are implemented in the coming years, nutrient load contributed by CSOs will drop precipitously. However, more importantly, improvements to the CSO system will mean drastically improved water quality to the Anacostia River.

5. D.C. Nonpoint Sources

Nonpoint source nutrients are generated throughout the entire land area and typically reach the rivers as runoff after rainstorms. These nutrients may be due to fertilizer use by homeowners and institutions in the maintenance of lawns and gardens, contained in sediments washed off the land, as well as waste generated by pets. Nonpoint source nutrients also are generated by natural processes and atmospheric pollution, but these are considered locally uncontrollable. Nonpoint source pollution reaches DC waters via tributary streams and via storm sewer outfalls in the Anacostia, Potomac and their local tributaries.

D. Sources of Sediment

1. Chesapeake Bay

Sediments are a natural part of the Bay ecosystem. Sources of sediment to the Bay include erosion of soil off of land during rain or snowmelt events that is carried away to local rivers and streams. Soil erosion caused by wave action along the Bay shoreline is also thought to be a major source of sediments. At the present time, sediment transport is simplified in the Bay’s water quality model and not well represented. Future model revisions are anticipated to address this issue and provide a clearer picture of the role of sediments in the Bay’s health.

2. External Sources

Anthropogenic inputs from the upper watershed outside District borders are the primary source of sediments to District waters and the Chesapeake Bay. As with nutrients, the external source is runoff from agriculture and forests. In addition, the Anacostia and Rock Creek basins are highly urbanized and flow of sediment-laden water arises from street runoff and instream erosion.

3. D.C. Point Sources

The major permitted source of sediments to District waters is the Dalecarlia Water Treatment Plant (WTP). The Washington Aqueduct, a division within the Baltimore District of the U.S. Army Corps of Engineers, manages the plant. The Dalecarlia plant has a capacity of 164 million gallons per day (mgd) based on filtration rates of two gallons per minute per square foot, and a maximum capacity of 264 mgd. Its treatment scheme consists of screening, chemical additions for flocculation and sedimentation, rapid sand filtration, and chemical additions for chlorination, fluoridation and pH control. Water for treatment comes from the Potomac River. As part of the treatment process, sediment carried by the Potomac River settles out in large basins through the use of the coagulant aluminum sulfate. These sediment basins are periodically cleaned of sediment build up by discharging of raw water, accumulated sediments, and accumulated coagulant back into the Potomac in accordance with the terms of its NPDES permit issued by USEPA Region 3.

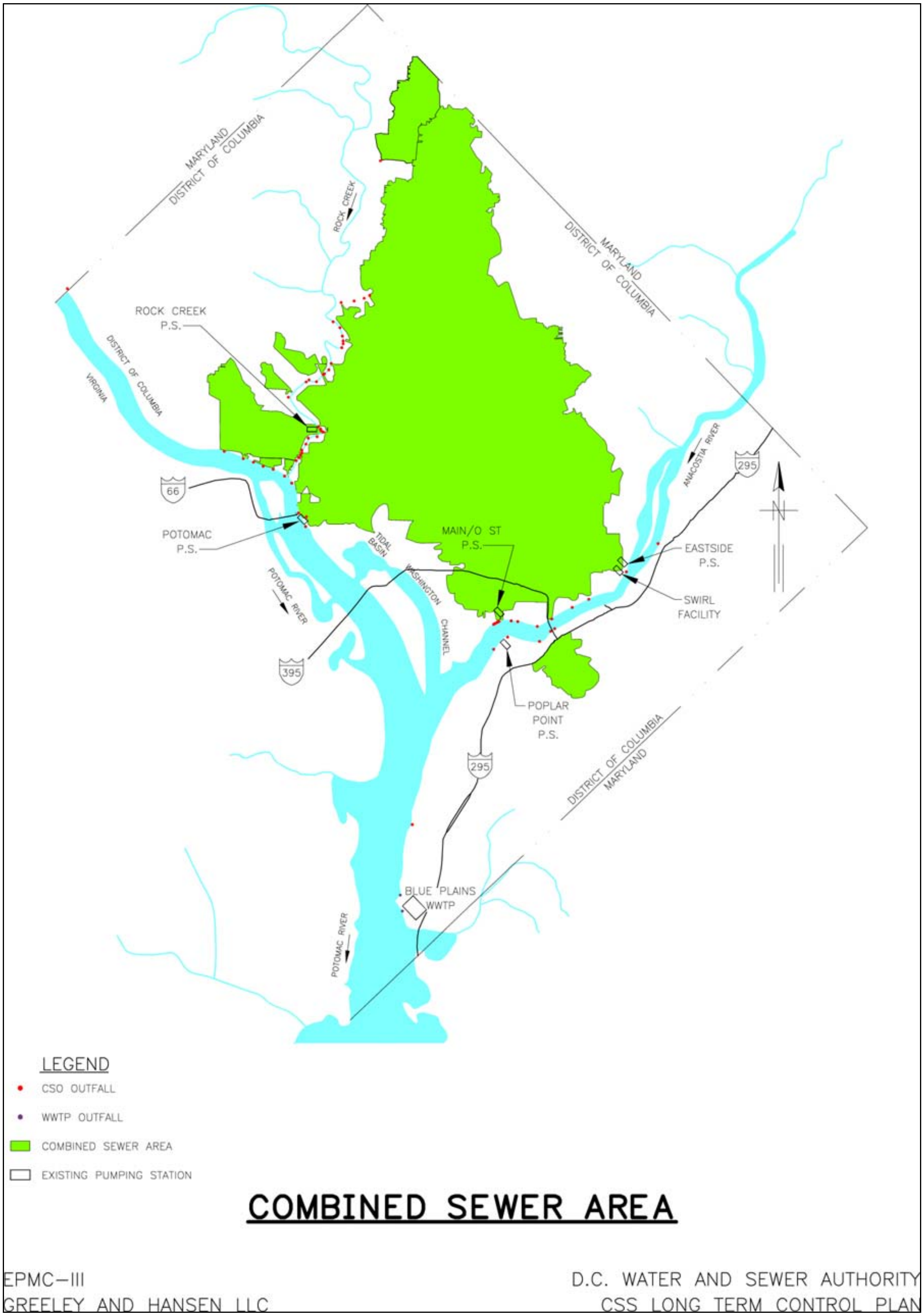
4. D.C. Nonpoint Sources

Construction site runoff is a major source of sediment in urban areas such as the District of Columbia. Once land-surface disturbances are stabilized, the amount of sediment entering District waters from direct surface runoff or discharge from storm and combined sewer outfalls is greatly reduced. Wash-off from both pervious and impervious surfaces also adds to the sediment load. Lastly, stream channel erosion caused by high volumes of runoff from impervious surfaces to local streams also contributes, although the amount and its transport are not well understood.

5. D.C. Shoreline Erosion

The allocation to the partners for nutrients and sediments includes an underlying agreement to reduce erosion of the tidal shorelines by 20%. A large portion of the shoreline in the District is already armored. The District has an active program of constructing fringe wetlands as a means of reducing both instream and near shore erosion. A survey will be conducted to determine the exact amount of eroding shoreline and a calculation of the amount of rehabilitation required.

FIGURE 4: MAP OF THE CSO FROM THE LONG TERM CONTROL PLAN



PART II-NUTRIENT REDUCTION PROGRESS 1985 TO 2001

A. Nutrient Load Reductions

The District has reduced nutrients by 40 percent since 1985 and has met its commitment under the original Chesapeake Bay Agreement. Lead by extremely successful implementation of new nutrient removal technology at Blue Plains, with improvements in CSO management, nutrient loads in the District have been substantially reduced.

TABLE 1: NUTRIENT LOAD REDUCTION, 1985-2000

Nutrient Source	Modeled 1985 Base Load	1985 Controllable Load	40% Reduction Goal	Modeled 2000 Load	% Reduction
Total Nitrogen					
- Point Source	7,831,740	7,831,740	4,699,044	4,548,770	42%
- Nonpoint Source	485,667	485,667	291,400	404,104	17%
TOTAL Nitrogen	8,317,407	8,317,407	4,990,444	4,952,874	40%
Total Phosphorus					
- Point Source	105,423	105,423	105,423	98,452	7%
- Nonpoint Source	54,898	54,898	32,939	38,825	29%
TOTAL Phosphorus	160,321	160,321	138,362	137,277	14%

Source: Chesapeake Bay Program WSM 4.3 outputs

The District's share of flow from the Blue Plains Wastewater Treatment Plant contributes 90 percent of the total nitrogen load from the District. The total flow from Blue Plains, including flow from surrounding jurisdictions, makes this facility the largest point source for nitrogen in the entire Potomac basin. Blue Plains discharges 47 percent of the nitrogen and 24 percent of the phosphorus from all point sources in the Potomac basin, and roughly half of that flow comes from the District. Blue Plains already is removing phosphorus to levels nearly at the limits of current technology. As a result, its phosphorus load is small relative to nitrogen. Nevertheless, because the flow is so large, the phosphorus it discharges accounts for 67 percent (2001) of the District's total phosphorus load.

CSOs are intermittent, and therefore annual nutrient loads from them will vary depending on rainfall patterns. It is estimated that in 2001,CSOs contributed 39 percent of the District's phosphorus load and 5 percent of the nitrogen load (source: CBP WSM 4.3 model outputs).

Monitoring data indicate that nonpoint source runoff accounts for a larger fraction of the District's nutrient pollution load than previously estimated: 10 percent of the nitrogen and 32 percent of the phosphorus (2001). Nonpoint source pollution control is important because runoff is also the major source of other pollutants that seriously degrade water quality in District waters.

In 2001, the District was the source of 6 percent of the nitrogen and 3 percent of the phosphorus, from point and nonpoint sources combined, which the Potomac basin contributed to the Chesapeake.

Table 1 shows for the 1985 Base nutrient loads and the nutrient reduction goals for the District of Columbia. The base load is an estimate of nutrient pollution levels in 1985. The controllable load is the 1985 base load excluding the amount of nitrogen and phosphorus expected to come from the District if it were totally forested. The 1987 nutrient reduction goal was to reduce nutrient pollution levels to 40 percent below the 1985 controllable load amount by the year 2000, and then maintain that lower level indefinitely. That lower level of nutrients is called the load cap. Meeting the nitrogen reduction goal required the District to reduce annual nitrogen pollution from about 8.2 million pounds to just under 5 million pounds per year.

B. Sources of Nutrient Load Reductions

The District of Columbia took a number of steps to reduce pollution from both point and nonpoint sources to meet its obligations under the original Chesapeake Bay Agreement. To address water quality problems in the tidal Potomac, the District's Blue Plains Wastewater Treatment Plant was upgraded in the 1970s and early 1980s, significantly reducing organic carbon, nitrogen and phosphorus loads. In addition, the District promulgated legislation in 1987 prohibiting use of phosphate detergent, thus further reducing discharge of phosphorus to its waters. Denitrification at BPWWTP was already achieving about a 20-30% reduction in total nitrogen loads as compared to WWTP using secondary treatment.

The District has also established several programs to reduce nonpoint source pollution. These include the adoption of a nonpoint source management program in 1985, a combined sewer overflow abatement program, and an Anacostia River restoration program focused on reducing nutrient, organic, and toxic pollution to the Anacostia River.

1. Point Sources

The largest source of the nitrogen load attributed to the District in 1985 was from the Blue Plains Wastewater Treatment Plant. Therefore, nitrogen reduction at Blue Plains was necessary for the District to achieve its nitrogen reduction goal.

Since the early 1980s the District of Columbia has investigated different nitrogen removal options for the Blue Plains Wastewater Treatment Plant. These studies included the *Blue Plains Feasibility Study* (Greeley and Hansen, 1984), *Deep Bed Denitrification Filters at Blue Plains* (Greeley and Hansen, 1989), and *A Feasibility Study for Biological Nutrient Removal at the Blue Plains Wastewater Treatment Plant* (McNamee, Porter and Seeley, 1990).

Nitrogen removal costs from these studies were summarized in a report by the Interstate Commission on the Potomac River Basin (Camacho, 1992), and updated in a study by Engineering Science, Inc (1993) prepared for the Metropolitan Washington Council of Governments. Based on various engineering studies, three options were evaluated for the nutrient reduction strategy of the District of Columbia. They were three-stage biological nitrogen removal (BNR), five-stage BNR, and implementing the limits of technology in nitrogen removal.

After extensive research, three-stage BNR was selected as a technological upgrade for Blue Plains. With this technology, BNR is obtained by retrofitting the existing nitrification tanks to create an anoxic zone for denitrification. Methanol is added in the fourth pass in the existing nitrification reactors as a carbon source to achieve biological denitrification. It was the implementation of BNR that enabled the District to achieve its 40 percent reduction of nitrogen goal.

This technology was installed first as a pilot in 1996, treating about half of Blue Plains' total flow. In 2000, the plant applied BNR to its entire flow. A study by ICPRB found that ambient nitrate levels have significantly declined in the tidal Potomac when BNR is operating. Before and after comparisons indicate nitrogen concentrations decreased between 22 and 63 percent, depending on season and flow in the upper half of the tidal Potomac after full BNR implementation (Potomac Basin Reporter, Vo. 58 No. 6 November/December 2002).

2. CSO Abatement (Phase I)

Historical efforts to manage wastewater and stormwater in the District of Columbia were primarily concerned with the transport of stormwater and sanitary sewage to nearby waterways for disposal. This "combined system" carries both domestic wastes and rainwater in a common sewer to the treatment plant. At the beginning of the CSO abatement program, one third of the District, approximately 12,500 acres, was served by a combined system that can overflow to waterways during rainstorms.

Although these overflows have significant impacts on all three receiving streams in the District (the Anacostia, the Potomac, and Rock Creek), the Anacostia receives a disproportionate share. The combined sewers overflow at 13 sites along the Anacostia south of RFK Stadium, accounting for 63 percent of the combined overflow in the District. The most serious results of combined sewer overflow are fecal contamination and low dissolved oxygen caused by high levels of biological waste. Storm events regularly cause violations of the official water contact recreation standards using fecal coliform bacteria. The Anacostia River also is subject to frequent fish kills and elimination of game fish species due to severe dissolved oxygen depletion. The effects of overflows have included immediate depletions of dissolved oxygen following the discharges. These oxygen depletions are sometimes so extreme that they result in large kills even of hardy carp and catfish populations, and long-term buildup of oxygen-demanding materials in bottom sediments. Another effect is the aesthetic degradation due to the discharge of combined system overflow suffered by all three streams.

In 1983 it was estimated that under normal precipitation conditions, the combined system would allow overflows 85, 80, and 17 times a year on the Anacostia, the Potomac, and Rock Creek, respectively. At that time, the District undertook a program for abatement of pollution from the combined sewer overflows. It consisted of increasing pumping capacity to direct more of the combined sewer flow to Blue Plains for treatment, increasing temporary storage of storm flows, separating combined systems in some areas, and treating CSOs at the points of discharge. The largest single investment, at a cost of $18 million ($14.5 million federal, the remaining, D.C.), of the program has been the Northeast Boundary Swirl Concentrator. In operation since 1991, it can treat up to 400 million gallons of combined sewage per day, removing grit, reducing settleable solids, and chlorinating and dechlorinating the effluent. The District of Columbia completed phase I of the CSO abatement program with an investment of about $32.6 million (including $22.8 million federal), including the cost of the Northeast Boundary swirl concentrator.

In 1994, the USEPA issued a national CSO Policy, which requires municipalities to develop a long term control plan (LTCP) for controlling CSOs. The CSO policy became law with the passage of the federal Wet Weather Water Quality Act of 2000. In 1998, USEPA convened a "Special Panel on Combined Sewer Overflows and Stormwater Management in the District of Columbia." This panel was comprised of representatives from 25 local, regional and federal agencies that have an interest in water quality issues in the District. The panel issued its report that included a number of recommendations for the LTCP.

DC WASA submitted its LTCP Program Plan – its approach to collecting data and identifying alternatives for addressing the CSO problem to USEPA. An extensive monitoring program in accordance with a USEPA-approved Quality Assurance Project Plan was conducted from August 1999 to June 2000. The data gathered from this monitoring effort were used to develop computer models to evaluate alternatives for mitigating the impact of CSOs on receiving waters. DC WASA has a LTCP that will be an integral part of its 2004 Tributary Strategy (see CSO section Nutrient and Sediment Reduction Strategy).

3. Nonpoint Sources

Nonpoint source pollution contributed an estimated 5 percent of nutrients to waters of the District in 1985, and no significant reductions of nutrient loads were seen between 1985 and 2000. Because nutrient loads have been reduced overall, the percentage of nutrient loading attributable to nonpoint sources in the District has increased to 8 percent, although actual increases have not been seen in new monitoring data.

Environmental pollution from nonpoint sources occurs when water moving over land picks up pollutants such as sediment, bacteria, nutrients, and toxicants and carries them to nearby storm drains and waters. Sediment and pollutant-laden water can pose a threat to public health. Pollutants come from both natural sources and human activity.

Stormwater runoff and associated soil erosion are significant causes of lost natural habitat and poor water quality in the District of Columbia and the United States. USEPA and USDA have made the control of soil erosion and the treatment of stormwater runoff important features of their strategy to restore the quality of the Nation's waters. The District of Columbia, through the federal Clean Water Act (1987), The District of Columbia Water Pollution Control Act (1984), The District of Columbia Soil Erosion and Sedimentation Control Act (1977), and The District of Columbia Applications Insurance Implementation Act of 1976, has been given the authority to protect the health and safety of the residents and visitors by controlling nonpoint source pollution.

Nonpoint is not a significant source of nutrient loads, although it a major contributor to impairment of District waters, and the District has made significant investments in its Nonpoint Source Management Program since 1985. Nonpoint source pollutants of concern in the District of Columbia are nutrients, sediment, toxicants, pathogens, and oil and grease. The origins of these nonpoint source pollutants are diverse and include:

- stormwater runoff due to the high degree of imperviousness of urban areas
- development and redevelopment activities
- urbanization of surrounding jurisdictions
- agricultural activities upstream in the watershed

The control of nonpoint source pollution requires the cooperation of many environmental programs. In 1989, the District developed *The District of Columbia Nonpoint Source Management Plan* (DC, 1989), revised and updated *by The District of Columbia Nonpoint Source Management Plan II: Addressing Polluted Runoff in an Urban Environment* (DC, June 2000). The plan describes the various environmental programs and projects in place to help control nonpoint source pollution.

Many of the nonpoint source activities in the District are now covered under the District of Columbia's NPDES Municipal Separate Storm Sewer System (MS4) permit from USEPA. The permit was issued in April 2000. Much of the implementation of the permit requirements has been delegated to DC WASA, which manages most of the District's water and sewer infrastructure. Requirements of the permit are broad and demand considerable funding to implement. Different components of the permit will be implemented by different agencies necessitating negotiation and careful planning. DC WASA, DC DOH and DC DPW have signed a Memorandum of Understanding that defines and assigns responsibilities for compliance with the permit (December 2000).

The MS4 permit essentially addresses management of all stormwater that enters the storm sewer system for conveyance to receiving water bodies. In addition to managing the MS4 infrastructure with mapping, modeling and maintenance activities, the MS4 permit includes numerous activities designed to reduce the pollutants that are washed from the District's land area into storm drains during rain events. Programs include street sweeping, catch basin cleaning, leaf collection, rain leader disconnection program, storm sewer mapping and modeling and public education.

Management of the MS4 permit under NPDES is a major regulatory program. To provide for a management and financial structure for the program, the District Council passed D.C. Law 13-311, Stormwater Permit Compliance Amendment Act of 2000. This legislation provides for the collection of fees from various activities to fund work directly related to the NPDES MS4 permit and provides a mechanism for DC agencies to apply for reimbursement from the fees collected for work in support of the permit. It also created the MS4 Advisory Panel consisting of the Mayor, the Chair of the DC Council, the General Manager of DC WASA, the Director of DOH Environmental Health Administration, and the Director of DPW.

PART III-DISTRICT OF COLUMBIA 2004 TRIBUTARY NUTRIENT AND SEDIMENT REDUCTION STRATEGY

The strategy presented here reflects the District of Columbia's commitment to continue to reduce nitrogen, phosphorus and sediment from its waters. This document was prepared by the Environmental Health Administration of the District of Columbia Department of Health (EHA), the District's lead agency on Chesapeake Bay restoration efforts. The strategy recognizes that the District fulfilled its original agreement to reduce the controllable portion of nitrogen by 40 percent below 1985 levels. This 2004 strategy indicates how it plans to try and meet its new allocation for nitrogen and phosphorus as well as a new allocation for sediment. This strategy reflects a multifaceted approach by the District of Columbia to meet its goal under the *Chesapeake Bay 2000* agreement. It describes programs and activities in which the District can calculate the load reductions reached through the Bay Watershed Model. It also describes those many small projects and multitude of partners that are impossible to quantify but nevertheless plays a critical role in the city's overall reduction strategy. This strategy also takes into consideration the District's deep commitment to its citizens to restore the Anacostia River and revitalize its waterfront. It also recognizes that the Chesapeake Bay suffers from many sources of pollutants and that there are many different ways to solve the Bay's water quality problems.

It should be noted here that the District's commitment to water quality improvement in both District waters and in the Chesapeake Bay is rooted in the restoration of Anacostia River, one of the ten most polluted rives in the US. Efforts to restore the Anacostia will play a central role in rallying D.C. resident support for the overall Bay restoration. Integral to this goal is the CSO long-term control plan. The CSO long term control plan is the result of negotiations with DC WASA, environmental advocates, and USEPA to find a solution to the problem of combined sewer overflows to this degraded river. Implementation of the CSO long term control plan will be the single largest contributor to improved water quality in the Anacostia River. This effort closely fits with broader multi-agency efforts aimed at revitalizing the economic and transportation infrastructure in the neighborhoods adjacent to the Anacostia. It also fits into the District's attempts to address environmental justice issues in historically black Anacostia neighborhoods.

It is not common for water quality improvements to coincide directly with planned actions that improve access for residents, improve habitat for wildlife, heighten appreciation of natural resources, and reverse a city's legacy of environmental injustice. At this moment, this nexus of social, biophysical, and economic forces are all being comprehensively addressed in this one degraded watershed. What stems from this is a compounding of returns, where the investment in biophysical improvements sets the stage for improvements in local economies. This can be envisioned when new business might develop out of increased recreation opportunities, and also, general investment may improve in a neighborhood adjacent to an improved river. Improvements in local economies have the potential to improve the social dynamics of underserved neighborhoods. Investments in one area set the foundation for further improvements in other area, eventually leading to a reciprocating cycle of improvements.

To be sure, investments in new wastewater treatment plant technology will improve water quality in the Potomac River and will contribute to improved water quality in the Chesapeake Bay. This should be pursued as funding becomes available. However, these improvements are measured by traditional water quality tests with specific and narrow results. Broader investments in the Anacostia (the essential component being water quality improvements) have the potential to deliver benefits across a range of areas, that can be measured in reduced human stress levels, higher numbers of fish and bird species, lower poverty levels, *and* improved water quality. This investment has the potential to address environmental justice concerns that have been voiced by many citizens of the Anacostia communities. Prioritization of the construction of the long-term control plan is the lynchpin upon which many other efforts depend.

Just as keystone species are dependent upon the organisms further down the food chain, the keystone benefits of social parity and environmental parity depend upon water quality improvement in the Anacostia River. To the extent that we speed up the process of improving water quality in this degraded river, we speed up the progress towards these broader environmental, social, and economic gains.

A. Nutrient and Sediment Allocations

1. Bay Water Quality Criteria and the District of Columbia

The Chesapeake Bay 2000 agreement calls for the signatories by 2010 to achieve and maintain the water quality of the Bay and its tributaries to support the aquatic living resources and to protect human health and to remove the Bay and tidal portions of its tributaries from the list of impaired waters under Section 303(d) of the Clean Water Act. Restored water quality will mean higher dissolved oxygen levels, higher water clarity with fewer algae blooms, more submerged aquatic vegetation, and more fish. To accomplish this, the Chesapeake Bay Program under the direction of the Water Quality Steering Committee has recommended new designated uses for the Bay and the tidal tributaries that reflect living resource habitat requirements. These designated uses are: migratory fish spawning and nursery use, shallow-water bay grass use, open-water fish and shellfish use, deep-water seasonal fish and shellfish use, deep-channel seasonal refuge use.

With designated uses established, the Chesapeake Bay Program has made recommendations on what water quality criteria define the conditions necessary to protect these designated uses. The criteria are for water clarity, chlorophyll-a, and dissolved oxygen. Dissolved oxygen defines all uses, while clarity defines the shallow-water use and chlorophyll-a defines the open-water use.

It is the responsibility of each jurisdiction to review and revise its water quality standards. USEPA is strongly encouraging Bay states and the District to adopt these recommended water quality criteria as they apply to their waters and standards. As this report is being prepared, the District of Columbia is undergoing its triennial review of its water quality standards. The review should be completed in 2004. The District has proposed adopting the Bay Program's water quality criteria for dissolved oxygen, chlorophyll-a, and clarity (secchi depth) for all of its "tidally influenced Class C (aquatic life use) waters. The District has already adopted clarity and chlorophyll-a criteria for the Anacostia River.

2. The Nutrient and Sediment Allocation Process

With the water quality conditions defined, the Chesapeake Bay Program began a process to estimate the nutrient and sediment load reductions that will be needed to restore the Bay. The process was carried out in partnership with the USEPA, Maryland, Pennsylvania, Virginia, the District of Columbia, Delaware, New York, and the West Virginia. First, basin-wide nitrogen and phosphorus load caps were determined that were needed to meet dissolved oxygen criteria in the tidal Bay basin. Next, sediment load caps were estimated that were necessary to restore submerged aquatic vegetation. Basin-wide allocations were based on Bay Water Quality Model projections using a range of options. The model projections were not based upon all factors that were likely to cause and contribute to WQS violation but, rather, voluntary efforts by the partners to meet the proposed WQS. The nutrient option agreed to by the partners is a cap of 175 million pounds of nitrogen and 12.8 million pounds of phosphorus per year, coupled with a 20 percent reduction in shoreline erosion. This option simulated dissolved oxygen criteria attainment Bay-wide except in the deep waters of one mid-Bay segment.

The sediment load cap agreed to by the partners is 4.15 million tons per year. Partners arrive at the cap amount by linking sediment load reductions with submerged aquatic vegetation growth simulated in the Bay Water Quality Model. In alignment with this new sediment load cap, the watershed partners agreed to a new 185,000-acre bay grasses restoration goal by 2010.

Agreed upon basin-wide cap loads were then distributed by major tributary basin and jurisdiction. The USEPA also committed to 8 million pounds of nitrogen reduction through its Clear Sky Initiative by 2010. Basin/jurisdictional level caps for nitrogen and phosphorus "were adopted with the concept of nitrogen equivalents and a commitment to explore how actions beyond traditional best management practices might help meet Bay restoration goals" (Memorandum dated April 29, 2003, by Secretary Tayloe Murphy, Chair of the PSC). A nitrogen equivalent is an action that results in the same water quality benefit as removing nitrogen. There is a commitment to reevaluate the allocations and progress in 2007 using models upgraded with better science to reflect other factors that affect water quality. The District of Columbia is located in the Potomac basin, and so has only one tributary allocation. The District's cap allocation is 2.4 million pounds of nitrogen and 0.34 million pounds of phosphorus, and 0.006 million tons of sediment per year.

B. Nutrient and Sediment Reduction Strategy

To meet its nutrient and sediment allocations under the Chesapeake Bay 2000 agreement, the District of Columbia plans to use a multi-faceted approach that will include strict compliance with permitted water quality activities of Blue Plains (WWTP and MS4) and Dalecarlia WTP, the implementation of the District's approved long term control plan for CSOs, and enhancing current programs to reduce nonpoint source pollution. In addition, the District has developed Total Maximum Daily Loads (TMDL) for several of its water bodies. This strategy takes into consideration TMDLs for total suspended solids, dissolved oxygen and BOD where applicable.

1. Point Source Controls

Of the 17 NPDES permits that the District of Columbia certifies, the Blue Plains WWTP and combined sewer system, both managed by DC WASA, as well as the Washington Aqueduct WTP, are significant potential sources of point controls for nutrients and/or sediments. The selection of these point source controls recognizes the reductions in total phosphorus loading that have been achieved as a result of the phosphate detergent ban and the improvements in wastewater treatment.

The USEPA has been exploring the possibility of instituting a watershed permit to allow flexibility of regulated sources to meet basin-wide nutrient objectives. Such a program would allow for nutrient trading where sources would be allowed to offset excess discharges with nutrient reduction credits obtained from another source. Additionally, the District of Columbia is supporting an effort by Pennsylvania to seek funding to develop and establish a nutrient bank and registry, a first step in formulating a trading program. Recent Chesapeake Bay water quality model simulations demonstrate not only that the concept of nitrogen equivalents is technically valid, but also that it is reasonable to trade between basins to achieve optimal costs. The nutrient allocation should not be construed to be the same as a determination of the degree to which the source "causes or contributes to" a violation of WQS.

a. Blue Plains WWTP

<u>Description</u>

As described previously, the Blue Plains WWTP, discharges significant amounts of nutrients. However, by fully implementing its biological nitrogen removal program, Blue Plains actions helped the District of Columbia meet its 40 percent nitrogen reduction as called for in the 1987 Chesapeake Bay Agreement, becoming the first in the region to meet this goal. Its yearly average effluent concentration for total nitrogen is rated at 8.0 mg/L and for total phosphorus it is 0.18 mg/L. DC WASA has committed to a significant amount of capital improvements and has raised water and sewer rates to implement the plan. DC WASA has a ten-year, $1.6 billion Capital Improvement Program (CIP). Begun in FY 2001, this program, in the area of wastewater, will spend $348.9 million to upgrade and rehabilitate facilities involved in liquids processing, $483.8 in the solids processing (primarily for the construction of four egg-shaped digesters), and $219.3 for plant-wide upgrades. These expenditures are necessary if the plant is to continue to meets its NPDES permit at present levels.

The cost for additional nitrogen and phosphorus removal is not part of DC WASA's CIP. Therefore, funding alternatives would have to be sought. Table 7 in the cost estimate section summarizes the costs of voluntarily lowering total nitrogen and total phosphorus levels to meet Chesapeake Bay objectives. Incurring those additional costs would jeopardize the District's effort to quicken the timetable for implementing its LTCP, which is required by USEPA and would be a greater water quality benefit to its own waters, particularly the Anacostia.

<u>Recommendation</u>

- The District recommends that the Blue Plains WWTP maintain its level of operation in compliance with its permit requirements. It has been in the forefront of nitrogen and phosphorus control in the Chesapeake watershed. The District recommends that the plant continue to use BNR as a nitrogen reduction strategy and strive to achieve at least an annual average total nitrogen concentration in its effluent of 7.5 mg/L for its share of the flow and begin to optimize nitrogen removal voluntarily as technically feasible and cost effective. Optimization should be performed to determine the minimum levels achievable on an annual average with the current process trains. If the other states cannot meet their allocation through voluntary measures and if a regulatory approach becomes a necessity to achieve the allocation, then the District would support a watershed-based permit strategy for the Potomac basin.

- As described earlier, about 41 percent of the flow from Blue Plains is from the District. In order for Maryland and Virginia to meet their nutrient allocation, Blue Plains may be required to provide added treatment for a portion of its flow as needed. The cost of this "blended effluent" approach would depend on the level of nutrient reduction that will be needed by the other jurisdictions.

b. Combined Sewer Overflows

<u>Description</u>

With regard to the CSO strategy, DC WASA has completed development of its Long Term Control Plan (LTCP). The purpose of the plan is to control CSO discharges to District waters in order to improve water quality. This $1.265 billion plan will reduce overflows by 96 percent District-wide. While all three major District waterways—Potomac, Anacostia, and Rock Creek—will benefit from the plan, the Anacostia will see the greatest reduction.

The LTCP will necessitate extensive investment in the District's sewer infrastructure. The plan calls for the construction of 3 underground storage tunnels to capture and hold overflows until the rain subsides and the waste can be pumped back into the sewer system and travel to Blue Plains. Other elements of the plan include rehabilitation of existing pumping stations, separation or consolidation of sections of the system eliminating 14 outfalls and implementing a low impact development pilot project to be carried out on DC WASA's properties along the Anacostia River. Figure 5 geographically displays the recommended Control Program.

An estimated $940 million will go towards improvements to the Anacostia CSO system. The Potomac will receive about $250 in improvements while Rock Creek about $50 million. Projects in the LTCP are divided into two types: those paid for through DC WASA’s Capital Improvement Program (CIP) and those where a funding source has yet to be identified. Most of the required funding is not included the CIP. The plan proposes a 40-year schedule for full implementation if no assistance from the federal government is received. This timeframe, however, could be shortened to 15 years with considerable outside financial help. In FY 2003 the District of Columbia received $50 million in federal funds towards the implementation of the control plan, and the District continues to aggressively seek additional funding for future years.

<u>Recommendation</u>

- The District of Columbia recommends that DC WASA implement all components of the LTCP and to aggressively seek funding to shorten the construction timeline as much as possible. Implementation of the LTCP will have significant benefit beyond nutrient reduction since a large portion of the stormwater runoff in nearly 40 percent of the city will be treated at Blue Plains WWTP. Storm and sanitary sewerage will be treated and toxic pollutants associated with urban runoff will be removed. This will contribute to other goals of the Bay Program. Additionally, implementation of this plan will not only benefit the Chesapeake Bay but will also directly benefit the water quality of the Anacostia River and the revitalization of this section of the city.

FIGURE 5: RECOMMENDED CONTROL PROGRAM DEVELOPED BY DC WASA

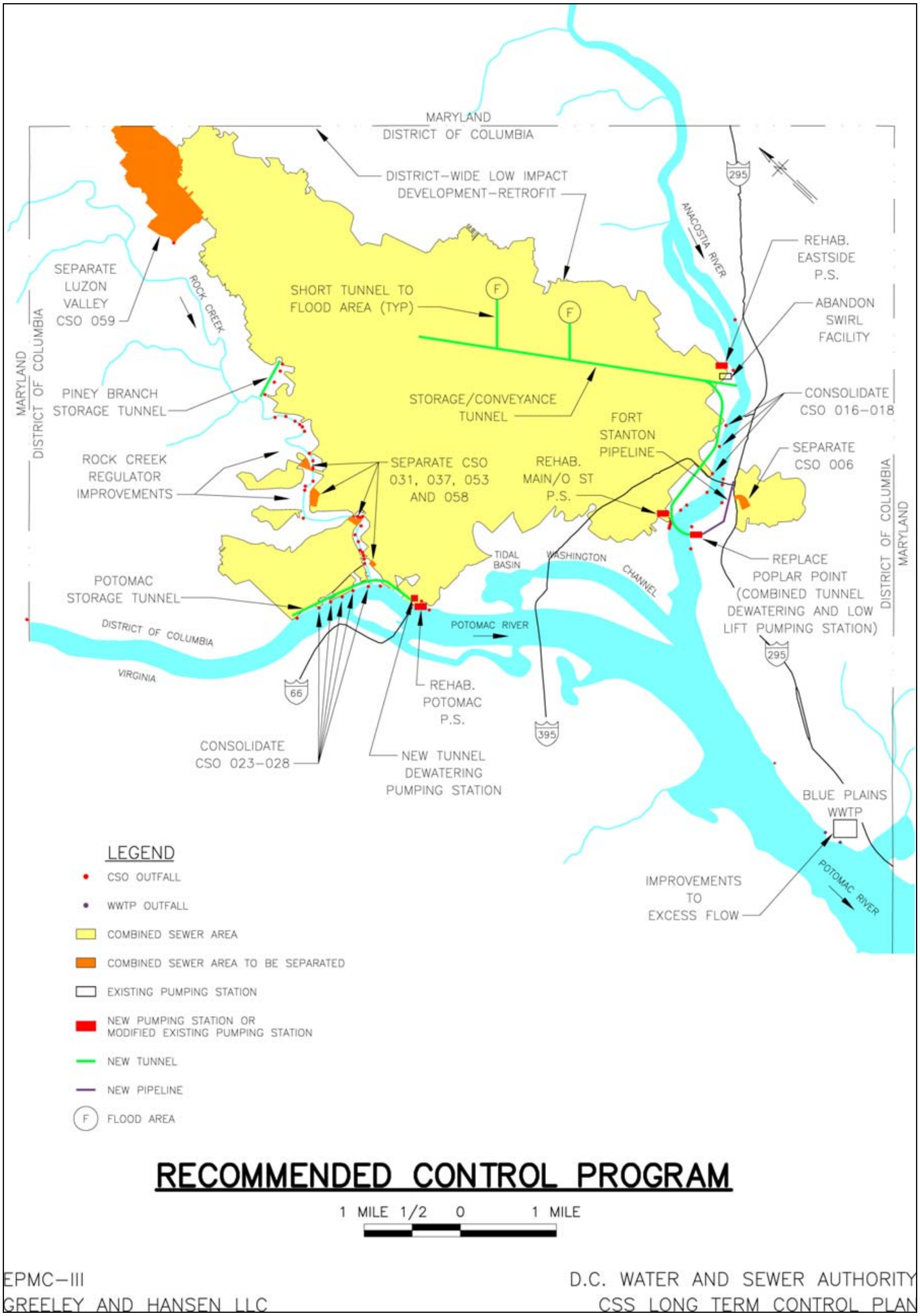


TABLE 2: LONG TERM CONTROL PLAN IMPLEMENTATION COMPONENTS

Component
System Wide
Low Impact Development - Retrofit (LID-R) - Advocated implementation of LID-R throughout entire city. Provide technical and regulatory assistance to the District Government. Implement LID-R projects on WASA facilities where feasible.
Anacostia River
Rehabilitate Pumping Stations - Rehabilitate existing pumping stations as follows: Interim improvement at Main and 'O' Street Pumping Stations necessary for reliable operation until rehabilitation of stations is performed. Rehabilitate Main Pumping Station to 240 mgd firm sanitary capacity. Screening facilities for firm sanitary pumping capacity only. Rehabilitate Eastside and 'O' Street Pumping stations to 45 mgd firm sanitary capacity. Interim improvements at existing Poplar Point Pumping Station necessary for reliable operation until replacement pumping station is constructed as part of storage tunnel.
Storage Tunnel from Poplar Point to Northeast Boundary Outfall - 49 million gallon storage tunnel between Poplar Point and Northeast Boundary. Tunnel will intercept CSOs 009 through 019 on the west side of the Anacostia. Project includes new tunnel dewatering pump station and low lift pumping station at Poplar Point.
Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer - 77 million gallon storage/conveyance tunnel parallel to Northeast Boundary Sewer. Also includes side tunnels from main tunnel along West Virginia and Mt. Olivet Avenues, NE and Rhode Island and 4th St NE to relieve flooding. Abandon Northeast Boundary Swirl Facility upon completion of main tunnel.
Outfall Consolidation - Consolidate the following CSOs in the Anacostia Marina area: CSO 016,017, and 018.
Separate CSO 006 - Separate this CSO in the Fort Stanton Drainage Area.
Ft. Stanton Interceptor - Pipeline from Ft. Stanton to Poplar Point to convey CSO 005, 006, and 007 on the east side of the Anacostia to the storage tunnel.
Anacostia Subtotal
Rock Creek
Separate Luzon Valley (CSO 059) – Completed separation of this drainage area.
Separation - Separate CSOs 031, 033, 036, 047, and 058.
Storage Tunnel for Piney Branch (CSO 049) – 9.5 million gallon storage tunnel.
Monitoring at CSO 033, 036, 047, and 057 - Conduct monitoring to confirm prediction overflows. If overflows confirmed, then perform the following: Regulator Improvements: Improve regulators for CSO 033, 036, 047, and 057. Connection to Potomac Storage Tunnel: Relieve Rock Creek Main Interceptor to proposed Potomac Storage Tunnel when it is constructed.
Rock Creek Subtotal
Potomac River
Rehabilitate Potomac Pumping Stations - Rehabilitate station to firm 460 mgd pumping capacity.
Outfall Consolidation - Consolidate CSOs 023 through 028 in the Georgetown Waterfront Area.
Potomac Storage Tunnel - 58 million gallon storage tunnel from Georgetown to Potomac Pumping Station. Includes tunnel dewatering pumping station.
Potomac River Subtotal
Blue Plains Wastewater Treatment Plant
Excess Flow Treatment Improvements - Four new primary clarifiers, improvements to excess flow treatment control and operations.

Source: DC WASA Long Term Control Plan Final Report July 2002

c. Washington Aqueduct

Description

The Washington Aqueduct is the drinking water treatment plant for the District of Columbia. As part of the treatment process, sediment (and attached phosphorus) is removed through screening, flocculation, and sedimentation. The USEPA issued a NPDES permit to the Washington Aqueduct (Permit # DC0000019) in March 2003 for water treatment solids management. The permit, however, was challenged and subsequently withdrawn. The USEPA, USACOE, and interested stakeholders have worked through the issues related to the permit, and it was issued in early 2004.

Below is a list of several components of the Washington Aqueduct permit that are critical to the District's sediment and phosphorus reduction strategy.

- Limitation on discharges during spawning season (February 15-June 15)
- New required river flow levels for discharges from the Dalecarlia sedimentation basins and the Georgetown sedimentation basins.
- Extended duration of discharge at Georgetown sedimentation basins and the use of more flushing water.
- Developing a plan to remove 85 percent of incoming sediments (and not return them to the river) and beginning execution of that plan within the permit period.
- Securing a permit to remove rocks from the front of the discharge structure in the Potomac that serves the Dalecarlia sedimentation basins.
- A plan that details the manner in which sediment taken from the Dalecarlia Reservoir is disposed of properly.

Recommendation

- Under the old NPDES permit, the Washington Aqueduct was allowed to return to the Potomac River sediment collected as part of the treatment process. Under the new permit, the Washington Aqueduct will be required to develop a plan for an alternate disposal method. The District of Columbia recommends that this plan be developed in a timely manner and that the sediment removal strategy be implemented as soon as possible.

d. Nutrient Trading

Description

The Chesapeake Bay Program defines nutrient trading as the "the transfer of nutrient reduction credits, specifically those for nitrogen and phosphorus, between buyers (entities that purchase nutrient reduction credits) and sellers (entities that offer nutrient credits for sale). The Chesapeake Bay Program has developed draft guidelines of what they consider a sound trading program. The purpose of draft document is to provide guidance to jurisdictions considering developing trading programs, and to ensure consistecy with Chesapeake Bay Program goals and compatibility across jurisdictions. Although the District of Columbia does not have a trading program in place, it sees nutrient trading within major watershed basins as a potential way to meet allocation caps and reduce implementation costs. It also supports the concept of a nutrient bank and registry as an important step in developing a trading program. All jurisdictions will have to seek innovative ways, such as nutrient trading programs, to reduce loads if nutrient and sediment goals are to be reached.

Recommendation

- The District of Columbia supports the concept of nutrient trading in order to provide greater flexibility in meeting its nutrient allocation cap. As a first step, the District will support Pennsylvania's effort to obtain a USEPA watershed initiative grant to develop a nutrient reduction bank and registry. It will further work with other jurisdictions within the Potomac watershed and other basins to examine potential trading opportunities.

2. Urban Nonpoint Source BMP Controls

Following is a description of key management programs and activities that comprise the District's nonpoint source control strategy and the implementation of its NPDES MS4 permit. These control measures represent both the continuation of current programs to reduce nonpoint source pollution before it enters the storm sewer system and proposed program enhancements. They include installing both conventional and innovative BMPs.

a. Municipal Separate Storm Sewer System (MS4) Permit

Description

The District of Columbia upgraded its Stormwater Management Plan (SWMP) in October 2002 and a new draft permit was issued by USEPA in November 2003. Components of the implementation plan include:

- Management Plan for Commercial, Residential and Government Areas
- Management Plan for Industrial Facilities
- Management Plan for Construction Sites
- Flood Control Projects
- Monitor and Control of Pollutants from Municipal Landfills or Other Municipal Waste Facilities
- Monitor and Control Pollutants from Hazardous Waste Sites
- Pesticides, Herbicide, and Fertilizer Application
- Deicing Activities
- Snow Removal
- Management Plan to Detect and Remove Illicit Discharges
- Enforcement Plan
- Public Education

The plan calls for the continuation of programs and activities listed in the District's most recent permit to control pollutant discharges at their source from entering storm sewers and calls for better tracking of illicit discharges. It shifts the focus from minimum stormwater controls to programs that encourage the use of functional landscape and other LID techniques to control and treat stormwater, including implementing a rain leader disconnection program. It also calls for a more coordinated approach to sweeping streets and cleaning catch basins in order to reduce stormwater pollutants. It requires that the District prohibit illicit discharges and prohibit dumping into the stormwater system and control spills. The plan encourages the development of a stormwater public education program that includes collection of animal waste and using environmentally friendly fertilizing and landscaping techniques. In carrying out the stormwater management plan, the permit states that the permitee cannot issue an exemption, waiver, or variance that would violate the federal Clean Water Act or USEPA regulations. The draft permit, however, is going through a public comment period, and the final permit requirements may change. Most of the programs described under the urban nonpoint section of this strategy are part of the District's MS4 permit's implementation activities.

Recommendation

- As required under the new MS4 permit, the District of Columbia should pursue the use of LID at all District government facilities undergoing construction or renovation. The MS4 Taskforce should be used as a tool to better coordinate the implementation of this strategy among the various District agencies, including DC DOH, DC DOT, DC DPW, and DC WASA.

b. BMP Implementation for Stormwater Management and Erosion Control

Description

Most nonpoint source pollution, especially sediments, in the District of Columbia comes from runoff associated with new construction, redevelopment, existing impervious surfaces, and land disposal of pollutants.

A soil erosion and sediment control program was established in 1974 to reduce sediment pollution to its streams and rivers. Regulatory authority for this program was established through the enactment of a soil erosion and sedimentation control law in 1977 and subsequent governing regulations. The law was amended in 1994 to remove the exemption of federal properties granted under the previous laws, and also to give regulators stop work authority.

In 1984, the District of Columbia developed a stormwater management program as part of its commitment to the 1983 Chesapeake Bay Clean-up and the 1984 Anacostia River Restoration Strategy Agreements, to help in the restoration efforts being undertaken in these two water bodies. Stormwater management regulations were developed in 1988 as part of the District of Columbia Water Pollution Control Act.

The primary objective of both of these programs is to control nonpoint source pollution by ensuring through a regulatory mechanism that the construction industry controls both quality and quantity of urban runoff from construction sites by using best BMPs. In addition to regulations, the District of Columbia developed a soil erosion and sediment control handbook and a stormwater management guidebook that are distributed to engineers, architects and building contractors. The purpose of these documents is to provide guidelines for the effective implementation of erosion and sediment control and stormwater management measures in accordance with regulations. Another document containing standards and specifications is also disseminated to designers and provides a variety of measures to control sediment from construction activities.

Initially, the erosion and sediment control and stormwater management programs were administered separately within DC DCRA. However, in January 1998 both programs were relocated from DCRA to the Department of Health along with other environmental programs under the Environmental Health Administration (EHA).

1. Stormwater Management

The main focus of the District's Stormwater Management Program is to ensure through a regulatory mechanism that developers use BMPs (either structural or nonstructural) to control both the quantity and quality of stormwater runoff from new development, redevelopment and retrofit projects. In order to accomplish the goal of the program, a *Stormwater Management Guidebook* was developed in 1988 to provide design engineers, architects, developers and urban planners the standards and specifications needed to meet the requirements of the regulations which were promulgated in their final form in 1988 under DC Law 5-188 (The District of Columbia Water Pollution Control Act of 1984). The regulations are outlined in section 526 – 535 of Chapter 5 of the District of Columbia Municipal Regulations (DCMR) Title 21.

In accordance with the stormwater management regulations, all development projects submitted to DC DOH for stormwater management approval must comply with the following minimum control criteria unless a waiver or a variance has been issued for the particular project:

- Stormwater management measures must be able to maintain post-development discharge levels at a rate equal to or less than the pre-development rate of discharge, for the 24-hour, 2-year, and 15-year storm events;
- In circumstances where planned development will result in increased downstream discharges into areas considered critical, a downstream analysis of the peak discharge for the 100-year storm event is required to ensure that proper control measures are installed;
- Discharge facilities receiving petroleum by-products such as oil and grease in concentrations exceeding 10 milligram per liter (mg/L) must install appropriate controls to prevent violation of the District of Columbia water quality standards;
- Discharge facilities receiving nutrient polluted runoff from areas used to confine animals must prevent a minimum of 85 percent of organic waste from leaving the BMP; and
- All stormwater management plans must conform to the District's erosion control and flood plain management criteria.

To satisfy the criteria, plans for all projects involving land disturbance of five thousand square feet are reviewed for compliance with the specific design standards and guidelines as outlined in the guidebook. Recommended BMPs for meeting the control criteria include on-site infiltration of runoff, flow attenuation using vegetated swales or natural depressions, stormwater retention or detention structures, and new/innovative technologies involving filtration utilizing a variety of organic and non-organic media. Table 3 below shows the classification and type of stormwater management BMPs approved for installation.

TABLE 3: DISTRICT OF COLUMBIA STORMWATER BMP CLASSIFICATION

LID	Exfiltration /Infiltration	Water Quality Sand Filters	Water Quality Inlets	Oil Water Separators	Water Quantity Control	Hydrodynamic Filtration Devices	Ponds
Bio-retention Cells (Rain Gardens)	Drywells	Manhole Sand Filter	Triple Inlet	Oil and Grit Separators	Corrugated Metal Pipe (CMP)	Stormceptor	Dry Ponds
Vegetative Biofilter (swale, strips)	Infiltration Trench	Underground Sand Filter	Double Inlet	Water Quality Structures	Reinforced Concrete Pipe (RCP)	StormFilter	Wet Ponds
Rain Barrels	Infiltration Basin	Pocket Sand Filter	Single Inlet		Roof Top Detention	Vortechnics	
Permeable Pavers	Perimeter Drains	Above Ground Sand Filter			Gravel Detention	Baysaver	

Source: DC DOH, Watershed Protection Division

Management of stormwater has evolved in the past decade. As a part of that evolution, the District of Columbia has updated its *1988 Stormwater Management Guidebook* (*District of Columbia Stormwater Management Guidebook–April 2003*) to incorporate innovative technologies such as low impact development techniques as well as BMP pollutant removal efficiencies. The Chesapeake Bay Program through its Urban Stormwater Workgroup, has classified all existing urban BMPs into nine broad categories as shown in Table 4. These efficiencies will be used to calculate BMP load reductions. The stormwater management regulations are currently being updated to reflect changes in technology. Similarly, changes to the District's plumbing and building codes have been undertaken in an effort to remove impediments to the implementation of low impact development BMPs for runoff control.

TABLE 4: STORMWATER BMPS AND POLLUTANT REMOVAL EFFICIENCIES

Category	% Pollutant Removal Efficiency		
	TN	TP	TSS
Wetponds and wetlands	30	50	80
Dry detention ponds and Hydrodynamic structures	5	10	10
Dry extended detention ponds	30	20	60
Infiltration practices	50	70	90
Filtering practices	40	60	85
Roadway systems (1)	TBD	TBD	TBD
Impervious surface reduction (2)	MG	MG	MG
Street sweeping (2)	MG	MG	MG
Stream restoration (3)	0.02	0.0035	2.55

Footnotes:

1. TBD - To be determined
2. MG - To be generated in Phase V of the Watershed Model
3. Units are in lb/linear ft

Source: MD Tributary Strategy Report/CBP Urban Workgroup 2002

2. Sediment and Erosion Control

In a city with limited space for new development, construction usually involves the redevelopment of abandoned lots, the replacement of old buildings with new buildings, or the rebuilding of roads. These activities can have a degrading effect on the waters of the District if effective erosion and sediment control measures are not implemented during construction. Implementation of erosion and sediment control is through the District's Erosion and Sediment Control Program.

The program implements and enforces D.C. Law 2-23 (*D.C. Erosion and Sedimentation Control Act of 1977*), which regulates all land-disturbing activities to prevent accelerated erosion and transport of sediment to its receiving waters. The program reviews and approves all construction and grading plans submitted to the District of Columbia Government for compliance with the regulations. Plans may call for the use of measures such as straw bale dikes, silt fences, brush barriers, mulches, sediment tanks or temporary sedimentation ponds, seeding or sodding, earth dikes, brickbats, stabilized construction entrances, vehicle wash racks, or a combination of measures to reduce the amount of soil washing away from construction sites during rainstorms. The sediment control program complements the stormwater management program. Therefore, in an effort to meet the goals and objectives of the USEPA Chesapeake Bay Program, the District strengthened its sediment control law by enacting D.C. Law 10-166 (*D.C. Erosion and Sedimentation Control Amendment Act of 1994*) to specifically remove the exemption in District building codes provisions for sediment control compliance associated with construction activities by federal agencies. This is an important amendment since one-third of District land is owned by the federal government.

In addition to the regulations, the program developed a handbook that is distributed to engineers, architects and building contractors. The purpose of the handbook is to provide guidelines for the implementation of erosion and sediment control measures in accordance with the regulations. A second document containing standards and specifications is also disseminated to designers and provides a variety of measures to control sediment from construction activities. The standards and specifications manual, first published in 1987, was recently updated as *The 2003 District of Columbia Erosion and Sediment Control Standards and Specifications* to include new and innovative erosion and sediment control BMPs. The District is also revising and updating its erosion and sediment control regulations and its 1987 erosion and sediment control handbook to meet current developments.

The Chesapeake Bay Sediment Workgroup's 2003 report cites construction-site runoff as the largest contributor of sediment in developing urban areas. Estimates of uncontrolled construction-site sediment loadings range from 7.2 to 1000 tons per acre per year. Sediment controls are estimated to be approximately 60 –70 percent effective in trapping construction site sediments, while erosion controls are estimated to be 80-90 percent effective. The report further cites a MWCOG (1987) study indicating construction site sediment loadings of 35 to 45 tons per acre per year. Although direct data on sediment loadings from construction sites in the District is not available, loadings can be assumed to fall within the 7.2 to 1000 tons per acre per year range. The Chesapeake Bay Program's nutrient loading efficiencies associated with erosion and sediment controls are estimated to be 33 percent for total nitrogen (TN) and 50 percent for total phosphorus (TP).

Recommendations

To meet the District's nutrient and sediment load reductions, the District will:

- Encourage, where applicable, the use of BMPs such as wetlands, vegetated biofilters, and bioretention facilities along with infiltration and other filtering practices such as sand filters that are capable of achieving 30-40 percent TN, 50-60 percent TP and 80-85 percent TSS removal. The revised Stormwater Management Guidebook will enable designers to select the BMP options that can best achieve the targeted removal efficiencies.

- Insure that plans for all construction projects involving earth disturbance are thoroughly reviewed for erosion and sediment control compliance along with aggressive enforcement of site inspections to ensure effective erosion and sediment controls.

- Review stormwater pollution prevention plans for construction activities greater than one acre for compliance with MS4 permit conditions. The District will work with the facilities to insure BMPs chosen will maximize nutrient and sediment load reductions.

- Continue to work with the CBP Nutrient Subcommittee's Tributary Strategy Workgroup to evaluate potential BMPs, including assessing nutrient and sediment efficiencies, for incorporation into the Bay Program's list of approved BMPs.

- Work with cooperating agencies and landowners to identify potential retrofit opportunities and to help, where feasible, to overcome possible impediments to implementation.

c. BMP Inspection, Enforcement and Maintenance

Description

When the erosion and sediment control and stormwater management programs were relocated to DC DOH, a separate inspection and enforcement program for BMP installations was formed within the Watershed Protection Division (WPD). The purpose of the program is to strengthen compliance with the District of Columbia's soil erosion and sediment control and stormwater management regulations in an effort to fulfill its commitments to cleanup its rivers and the Chesapeake Bay. The program is responsible for the inspection and enforcement component of the erosion and sediment control and stormwater management regulations as well as the investigation of citizens' complaints relating to soil erosion and drainage problems. The program assures compliance with the regulations by inspecting the installation of BMPs, monitors and directs maintenance and adherence to design standard and specifications during construction, and authorizes the removal of temporary controls as construction sites are permanently stabilized. WPD has also instituted an aggressive maintenance program to ensure that permanently installed stormwater management BMPs continue to function properly throughout their design life.

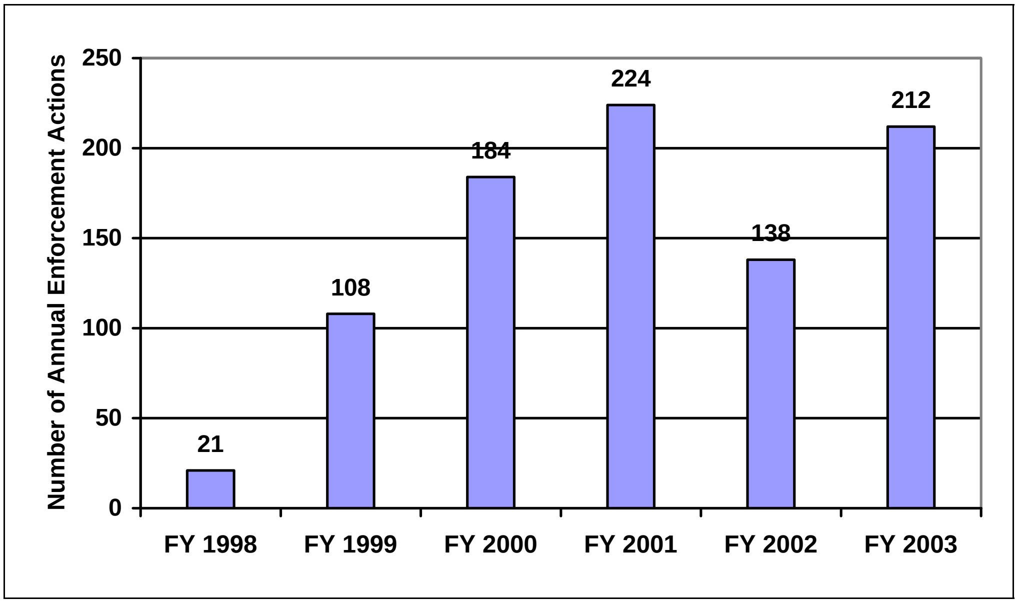
1. Inspection and Enforcement

The overall goal of inspection and enforcement program is to coordinate, facilitate, manage, and plan activities to protect the water quality and aquatic resources in the Potomac and Anacostia watersheds by developing and implementing an efficient and effective inspection and enforcement program in support of the regulation of land-disturbing activities. In order to achieve this goal, WPD conducted an assessment of the program that existed after the realignment in 1998. Based on this assessment, a 5-year strategic plan was prepared and implemented. The strategic plan highlighted the following critical components where improvements were needed: an increase in the number of inspections by hiring additional inspectors, development and implementation of a formal stormwater management maintenance program, strengthening of the enforcement authority of existing regulations and development of new operating guidance. Five new inspectors have been hired since 1998, significantly increasing our enforcement capability. The program improvement components are discussed below.

The District of Columbia enacted the Civil Infractions Law (D.C. Law 6-42) in 1987, to strengthen the enforcement of existing regulations. Under this law, inspectors are authorized to impose fines for each violation of the regulations. Initially, the soil erosion and sediment control and stormwater management regulations were not included in the Civil Infractions Law. However, the law was subsequently amended to include these regulations. The mechanism to fully implement the Civil Infractions Law for this program has been developed and is currently being implemented. WPD also updated the Civil Infractions Schedule of Fines for Soil Erosion and Sedimentation Control and Stormwater Management, which have been in place since December 1999. Additionally, our enforcement capabilities were further strengthened through the implementation of stop work order authority included in The Soil Erosion and Sedimentation Control Amendment Act of 1994.

Figure 6 illustrates the significant increase in the levels of enforcement activities since the District implemented its 5-year strategic plan to improve the inspection and enforcement program. In 1998, the year before the program was fully implemented, only 21 enforcement actions (Notices of Violations only) were taken. The number of enforcement actions increased dramatically to 224 by 2001. However, since then the number of enforcement actions has started to decline, indicating that the construction industry is responding positively to the increased levels of enforcement activity along with outreach and education.

FIGURE 6: NUMBER OF ENFORCEMENT ACTIONS TAKEN



More that 20 different types of ultra-urban stormwater management BMPs with varying levels of inspection requirements have been installed in the District. The types of BMPs include infiltration/exfiltration devices, sand filters, water quality inlets, oil/water separators, hydrodynamic devices and stormwater ponds (see Table 3). Additionally, numerous soil erosion and sediment control BMPs are installed at construction sites on a daily basis and must be inspected to ensure compliance with approved plans.

The use of low impact development techniques (LID) such as rain gardens, porous pavement, and green roofs, has gained interest in the stormwater management community. However, in order for any BMP to function effectively after construction, particularly LID, proper construction techniques and strict adherence to design specifications must be followed during installation. The most effective tool at our disposal to ensure compliance is timely inspections during construction and proper maintenance after construction. Timely inspection and enforcement is extremely important since sediment and nutrient load reduction calculations are based on the assumption that all BMPs are constructed and maintained properly. Figure 7 shows the increasing number of construction site inspections conducted for stormwater management and erosion & sediment control.

As part of the program development and implementation, DC DOH developed new standard operating procedures (SOP) for inspection and enforcement. The purpose of the standard operating procedures was to provide a consistent framework for conducting inspection, issuing notices of violations, civil infraction fines, and stop work orders for violation of the District of Columbia's soil erosion and sediment control and stormwater management regulations.

FIGURE 7: NUMBER OF CONSTRUCTION SITE INSPECTIONS CONDUCTED FOR STORMWATER MANAGEMENT AND SOIL EROSION & SEDIMENT CONTROL

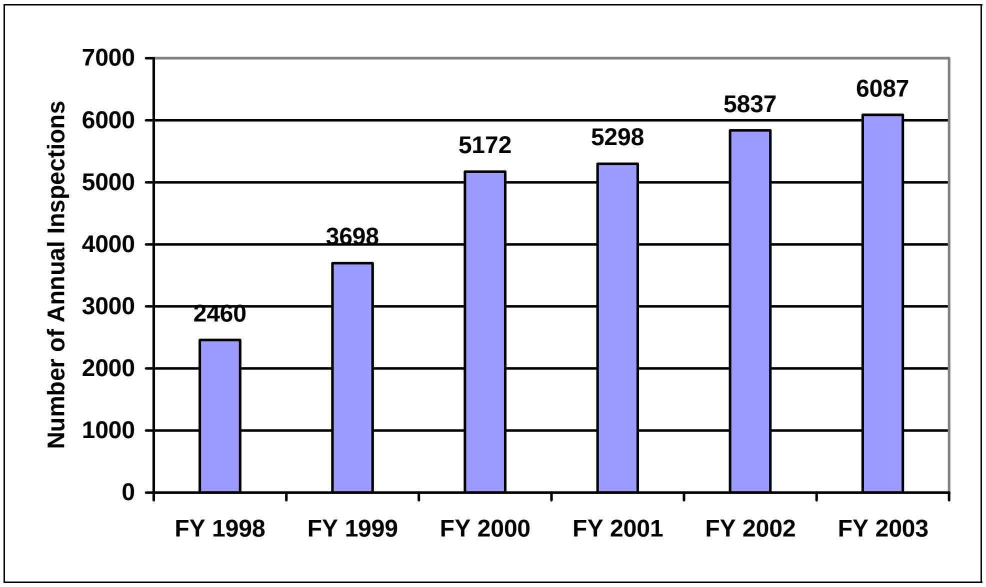
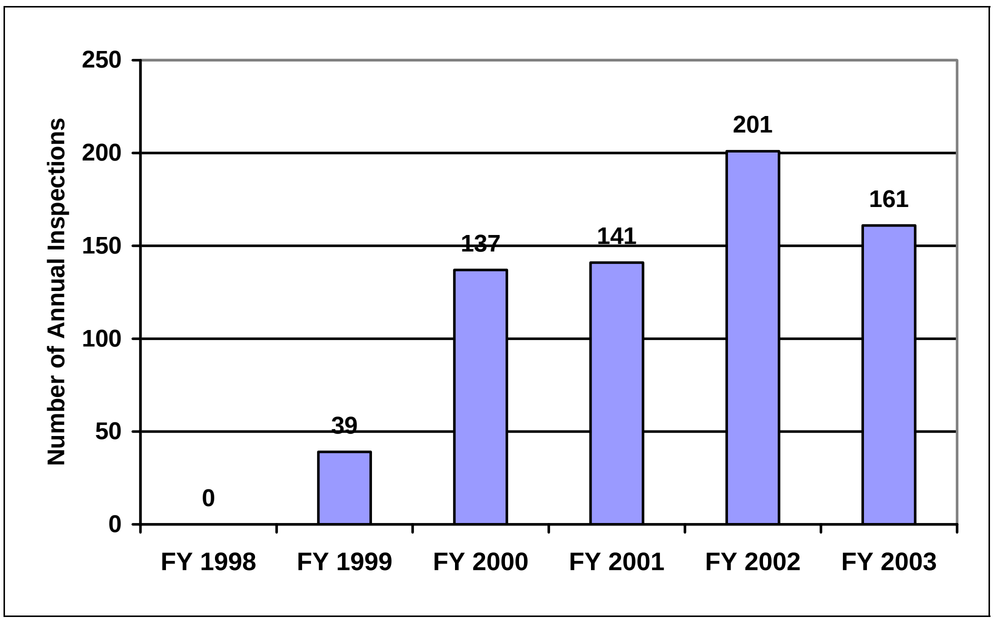


FIGURE 8: NUMBER OF STORMWATER MANAGEMENT BMPS INSPECTED FOR MAINTENANCE



There are three (3) enforcement remedies to be used to respond to violations of the soil erosion and sedimentation control and stormwater management regulations. They are, in increasing order of severity:

- Notices of Violation (warning)
- Notices of Infraction (the civil infractions ticket with the fine)
- Stop Work Orders

In determining which remedy to select, the following factors are considered: the nature and severity of the violation(s), the urgency with which remedial activity must be taken, whether the violator has taken good faith measures to come into compliance, and whether the violation is a repeat offense. A stop work order (SWO) is generally considered the most extreme enforcement remedy available, since it requires cessation of all site work except that necessary to correct the violation(s). SWOs are used only in cases where there is an immediate environmental or health and safety threat, where work is being conducted without an approved plan, or where other remedies have failed to correct the violation(s).

Civil infraction fines range from sixty to five thousand dollars ($60 to $5,000) depending on the nature of the infraction and whether the violator is a repeat offender. Additionally, enforcement procedures stipulate that anyone convicted of violating the stormwater management regulations is guilty of a misdemeanor, and upon conviction is subject to a fine of at least two thousand five hundred dollars ($2,500) but no more than twenty-five thousand dollars ($25,000).

2. BMP Maintenance

Since the inception of the stormwater management program, over 1000 facilities or BMPs have been installed at new development and redevelopment projects throughout the city. Figure 8 shows the number of stormwater management BMPs inspected for maintenance since 1999. These BMPs are used for nonpoint source pollution control, and hundreds more have been approved for on-going development projects. Most of these stormwater management BMPs are installed beneath impervious surfaces such as parking lots and sidewalks due to the high cost of land and lack of space, and are generally not visible.

Initially, the District of Columbia did not have a formal program for stormwater management BMP maintenance. Like most other jurisdictions throughout the Chesapeake Bay Watershed, the primary focus was on the construction and installation of BMPs to meet regulatory requirements. However, recognizing that proper operation and maintenance of BMPs was critical to sound stormwater management, and ultimately to the health of its rivers and streams, the DC DOH developed and implemented an aggressive stormwater management facilities maintenance inspection program in 1999.

Maintenance responsibility designation is critical to ensuring that maintenance service is performed as needed throughout the design life of the stormwater BMP. District of Columbia Municipal Regulations (DCMR) require that the owner of property or agent in control of the property on which a stormwater BMP has been constructed, maintain the facility in good condition and promptly repair and restore it whenever necessary. The District's stormwater regulations enable the DC DOH Maintenance Inspection Enforcement Program to implement enforcement measures for all stormwater BMPs throughout the entire District of Columbia. The DCMR definitions of a stormwater BMP and the person or persons responsible for its maintenance are also broad enough to capture the numerous unique circumstances that determine ownership and who is responsible for maintenance of the stormwater BMPs in the District. The municipal code defines stormwater BMPs as grade surfaces, wall drains, structures, vegetation, erosion and sediment control measures, and other protective devices.

As part of the protocol for stormwater management site plan approval, a “Maintenance Agreement” requires designation of the “Person Responsible for Maintenance” of the stormwater BMP. It states that the undersigned agrees to maintain and operate the discharge facilities in such a manner as to comply with the provisions of DC law. Maintenance responsibility is further clarified by a specific maintenance covenant that is required to be recorded on the Property Deed by regulation and “runs with the land” in the event of a change of property ownership where a stormwater BMP is located.

The maintenance covenant is an important tool that informs the current owner and any future owner of not only the existence of the stormwater BMP, but also of the specific maintenance schedule which ensures that the BMP will be maintained in tip-top condition to treat stormwater. Language is also included in the maintenance covenant that authorizes the District to enter the property in the event that the owner fails to maintain the BMP after notification. This in effect deems that the stormwater facility is an imminent hazard and authorizes the District to make repairs and to perform all maintenance, construction and reconstruction necessary in order to maintain the stormwater facility as designed to treat stormwater. The District may then assess the owner for the cost of the work and applicable penalties.

The program has evolved into a very effective water management maintenance program. An instructional video containing all the important elements of maintaining a stormwater management facility was produced and disseminated to property owners and maintenance contractors for educational purposes. Following inspections, stormwater management facilities are restored on an as-needed basis, and appropriate enforcement actions are taken to ensure compliance.

<u>Recommendations</u>

The Inspection and Enforcement Program will implement the following activities in order to help meet the District’s sediment and nutrient allocation:

- The District will complete the revision and updating of its stormwater management and soil erosion and sedimentation control regulations for legislative review and approval. Once this project is completed, the District’s *Erosion & Sediment Control Handbook* will be updated to provide guidelines to the regulated community to comply with the regulations.

- Print and disseminate the recently completed revised Standards and Specifications for Soil Erosion and Sediment Control for the District of Columbia. In an effort to ensure shareholders involvement in the revision process, the District formulated a technical review committee consisting of representatives from the U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS), local building industry associations, and other District agencies who worked with DOH to provide technical review and oversight.

- Implement a contractor certification program that will result in an increased level of compliance and presumably further reduction in sediment and nutrients.

- Update DC automated database system for tracking stormwater management facilities inspected for maintenance to include tracking of construction projects with stormwater management BMPs. The updated database system contains data for BMPs constructed since the inception of the program in 1988 and has enabled faster and more efficient rescheduling of inspection and retrieval of maintenance records.

d. Low Impact Development Promotion

<u>Description</u>

Due to its urban land use and high percentage of impervious surface, the District of Columbia is exploring the use of low impact development (LID) as a technique to moderate the environmental impacts associated with stormwater runoff. LID refers to a stormwater management strategy that controls rain water at its source, distributing it so as to infiltrate into the groundwater instead of being shunted to a storm drain, pipe and stream. The terms functional landscapes and environmentally sensitive design also refer to the same concept. Depending on the site, LID may be used in conjunction with structural BMPs to duplicate hydrologic conditions.

In the District, not only are developers and engineers encouraged to consider LID when they submit stormwater management plans for approval, but they also are beginning to buy into this concept as an attractive, less costly alternative to traditional stormwater BMPs. As a result of this increased level of acceptance and encouragement, more LID projects have been approved and constructed in the District within the last four years. In addition to projects that are required by regulations to install stormwater BMPs, several non-regulatory LID projects including retrofits are being implemented. Examples of LID practices implemented in the District include vegetated swales, bio-retention cells, permeable pavement, permeable pavers, sidewalk filtration, tree-boxes, roof leader disconnections and rain barrels.

To date, the District has over 100 LID retrofits currently in place, including bioretention cells, curb cuts, permeable pavers, underground detention units, and vegetated roofs. Plans for LID retrofits at RFK Stadium and its immediate neighborhood have just been completed under partnership with the USACOE. Other LID implementation examples come from Peabody and Bancroft elementary schools, which are both slated for LID retrofits within the next year. Additionally, the District's MS4 draft permit calls for the District to use LID practices and promote the use of functional landscapes in stormwater management control.

In perhaps the District's most ambitious LID implementation activities to date, DC DOH will be funding an implementing agency to design and build up to thirty LID stormwater management installations within the District. These installations will demonstrate innovative, but simple methods to treat stormwater to reduce quantity and improve the quality of urban runoff going into our rivers. The funding will require the selected organization to choose from a list of potential locations, which have been solicited by DC DOH, for implementation of LID; disperse funds; acquire permits and oversee construction of these retrofits within the next two years. Funding for this program will come from the District of Columbia's Section 319 nonpoint source management program.

Overall, DC DOH is taking a comprehensive approach to LID promotion in the District. It is hoped that measures such as educating staff via seminars and workshops, addressing regulatory impediments to LID, standardizing techniques and funding demonstration projects within the District will help to protect the Chesapeake Bay from the damages associated with stormwater runoff.

Recommendations

- To provide incentives to employ LID, DC DOH should continue to pursue its cost share program to demonstrate LID and encourage stormwater retrofits.

- District of Columbia Government agencies should work together to identify and retrofit at government facilities for stormwater management control using LID techniques as specified in the MS4 permit.

- DC DOH should prepare literature targeting homeowners, explaining how to install and maintain functional landscape techniques such as rain gardens, rain barrels and green roofs.

- DC DOH should prepare a LID manual that gives guidelines and specifications for LID retrofits in development and redevelopment projects.

- DC DOH should continue to work through its schoolyard conservation program to use LID techniques on DC public school properties.

e. Stormwater Retrofits

Description

Early stormwater management in developing areas consisted of directing storm runoff to a sewer or neighborhood stream as quickly as possible. For the District of Columbia that meant connecting roof leaders directly to the sewer system and providing street catch basins to remove street runoff quickly to reduce flooding. Since 1987, new construction has required installation of BMPs. The District encourages stormwater retrofits to install BMPs on buildings constructed before 1987.

Stormwater management retrofits in the District are normally associated with existing road reconstruction/rehabilitation projects or special projects involving parking lot improvement. Such projects fall into the category of repair and maintenance. The typical BMPs used include catch basin inserts, different types of water quality structure, tree filter boxes, and LID techniques. To encourage retrofitting, the District is exploring ways to cost-share based on the total cost of a project and the availability of funds. Additionally, DC DOH and DC WASA, through the MS4 Taskforce, are looking for opportunities where sites can be retrofitted with catch basin inserts. So far, however, this voluntary approach has resulted in only a small amount of additional acreage served

The development of a more comprehensive strategy to retrofit the city for stormwater is critical to the District's implementation plans to meet local TMDL requirements. Local TMDLs will require the District to retrofit the entire city for stormwater management outside of the CSO area. Funding for such an effort will be very costly, especially in an ultra urban setting such as the District.

Recommendations

- Through the plan review and approval process for stormwater management and sediment control compliance, the District will explore opportunities for retrofits when feasible, and encourage developers to implement retrofits. Cost-share should be provided as a strong incentive.

- The District of Columbia DC DPW should retrofit 2,500 catch basins with water quality inserts.

- If funding is identified, the District should pursue a comprehensive strategy to retrofit the entire area outside the CSO for stormwater management, knowing that such an effort could not feasibly be completed before 2010.

f. Street Sweeping

Description

Although research on the subject has indicated that street sweeping was not very effective in reducing pollutant loads, improvements in sweeper technology have caused a recent reevaluation of their effectiveness. These recent street sweeper technology improvements have enhanced the ability of present day machines to pick up the fine-grained sediment particles that carry a substantial portion of the stormwater pollutant load. New studies have shown that conventional mechanical broom and vacuum-assisted wet sweepers can reduce nonpoint source pollution by 5 to 30 percent; and nutrient content by 0 to 15 percent. Newer dry vacuum sweepers can reduce nonpoint source pollution by 35 to 80 percent; and nutrients by 15 to 40 percent (Runoff Report, 1998).

Street sweeping plays an important role in the District's attempts to reduce street nonpoint source pollution. By capturing pollutants before they are made soluble by rainwater, street sweeping may reduce the need for stormwater treatment practices. Stormwater treatment practices that attempt to filter pollutants in solution can be very costly when compared to collecting pollutants before they become soluble. In fact, street sweepers that can show a significant level of sediment removal efficiency may prove to be more cost-effective than some stormwater treatment practices, especially in more urbanized areas with higher areas of paving, such as the District of Columbia.

The DC Department of Public Works (DC DPW) uses its mechanical street sweepers to clean residential streets that receive a high volume of pedestrian traffic and litter, and are near neighborhood commercial streets. Scheduled street sweeping is a weekly service in the residential sections of Wards 1, 2, 4, 5, 6, and 7 with high levels of pedestrian traffic. Street sweeping in commercial areas can occur more frequently, ranging from daily to weekly. 2002 street cleaning efforts in the District removed an estimated 9,199 tons of trash, debris, and pollutants carrying sediment from over 101,563 miles of the District's streets and alleys. In addition, DC DPW also emptied 8,920 tons of refuse from litter collection receptacles throughout the city. By providing and emptying litter receptacles, the District further helps to reduce refuse conveyed to the Chesapeake Bay via the city's storm sewer system.

Recommendation

- The District of Columbia supports the addition of street sweeping as an approved BMP under the Chesapeake Bay Program so that the District of Columbia can receive credit for nutrient and sediment load reductions from this practice.

g. Catch Basin Cleaning

Description

By catching course sediment and trash and debris, catch basins help prevent these solids from being washed into local waterways. However, catch basins must be cleaned periodically if they are to maintain their solids-trapping ability. The DC Water and Sewer Authority (DC WASA) is responsible for catch basin maintenance in the District of Columbia.

DC WASA is dedicated to the continued improvement of its catch basin cleaning performance. The Authority recently began emphasizing the maintenance of catch basins in areas prone to high water levels during periods of heavy rainfall. DC WASA also has pledged to clean catch basins in its combined sewer system (CSS) more frequently, and inspect catch basins in CSO areas that drain to the Anacostia at least two times per year. Table 5 represents DC WASA's catch basin maintenance efforts since 1995.

As can be seen, the rate of District catch basin maintenance has dramatically increased since the mid-nineties. These continued maintenance efforts are of great importance to the overall health of local waterways, especially considering that once a catch basin fills, inflow begins to have a flushing effect, actually adding sediment to incoming stormwater.

TABLE 5: CATCH BASIN CLEANING

Year	Number Cleaned	Total Basins	Annual Percentage
1995	13957	25000	56
1996	14364	25000	57
1997	15135	25000	61
1998	15615	25000	62
1999	21534	25000	86
2000	26798	25000	107
2001	31542	25000	126
2002	26015	25000	104
2003	27500	25000	110

Source: District of Columbia 2003 MS4 Annual Report

Recommendation

- The District of Columbia recommends that catch basin cleaning be included as an approved BMP under the Chesapeake Bay Program so that the District of Columbia can receive credit for nutrient and sediment load reductions from this practice.

3. Watershed Planning and Natural Resource Protection

The mission of DOH Watershed Protection Division is to conserve the soil and water resources of the District of Columbia and to protect its watersheds from nonpoint source pollution. The WPD serves this mission in a number of ways. In addition to enforcing stormwater management and sediment and erosion control regulations, as discussed previously, it has followed a comprehensive watershed management philosophy for nearly 20 years. At the center of this management philosophy are the Division's watershed management planning documents, called Watershed Implementation Plans (WIPS). These documents discuss all aspects of watershed restoration as they relate to their specific watershed or subwatershed, and establish a timeline for appropriate implementation measures. A number of the restoration measures employed throughout these WIPs are discussed in the following sections. These highlighted measures, while part of a holistic restoration strategy, also serve valuable pollutant reduction functions, helping to minimize loading of nutrients and sediments to the Chesapeake Bay.

a. Urban Riparian Forest Buffers

Description

Riparian Forest Buffers (RFBs) are linear wooded areas along rivers and streams. They provide valuable services that are crucial to the functioning of aquatic ecosystems. RFBs reduce nonpoint source pollution and improve water quality by helping to filter nutrients, sediments and other pollutants from runoff. They also provide habitat for aquatic and terrestrial organisms and improve the quality of life for human residents of urban areas. Extensive research on RFBs has produced a template for RFB protection and restoration that maximizes the functional benefits of riparian zones in a minimum area.

The Chesapeake Bay Program has examined for inclusion in the watershed model the relative effectiveness of RFBs to remove nutrient and sediment. In urban streams with a greater than 25 percent imperviousness, it is estimated that RFBs have a 25 percent removal efficiency for total nitrogen and a 50 percent removal efficiency for sediment and phosphorus-borne sediment.

Realizing the importance of RFBs, the Chesapeake Bay Program Executive Council committed in 1996 to conserving existing forests along all streams and shorelines, increasing the use of all riparian buffers, and restoring riparian forests on 2,010 miles of stream and shoreline in the watershed by 2010. The 2,010-mile goal was met in 2002, eight years ahead of schedule. In 2003, the Executive Council expanded the original forest buffer goal to 10,000 miles by 2010. The new directive also calls for encouraging increases in the amount of tree canopy in all urban and suburban areas by promoting the adoption of tree canopy goals as a tool for communities in watershed planning (see tree planting section below).

The District of Columbia does not have any legislative initiatives to promote the restoration of riparian buffers. However, since signing the original Forest Buffer Directive in 1996, DC DOH has supported activities to protect and restore buffered areas in the District. These activities include:

- Coordinating riparian planting efforts of diverse organizations and agencies of the federal and local government to support DC DOH WIPs.
- Expanding riparian zones to a minimum of 50 feet wherever possible; and
- Educating District residents about the important role riparian forest buffers play in healing aquatic and terrestrial ecosystems.

<u>Recommendation</u>

- In comparison to other jurisdictions within the Bay watershed with many stream miles, the District of Columbia has approximately 39 miles of streams, most of which reside on federal parklands. To the extent where opportunities will arise as part of larger stream and habitat restoration projects on both federal and DC lands, DC DOH will promote planting forest buffers to a feasible depth.

b. Tree Planting

<u>Description</u>

Tree planting is typically considered a BMP for agriculture land. However, it is also important in urban areas where trees are beneficial for their aesthetics and heat reducing properties as well as in helping to reduce the loss of nutrients and sediment from erosion.

Due to its highly urbanized nature, maintenance of the District's tree canopy requires intensive labor. Street trees must be planted and cared for, and the District's forested areas must be protected from exotic invasive species, pests and disease. Tree planting and maintenance fall within municipal or federal jurisdiction, depending on the tree's location.

The primary mission of the DC DOT's Urban Forestry Administration (UFA) is to plant and maintain the city's street trees. Street trees are those located between the city's curbs and sidewalks. The UFA plants approximately 4,000-5,000 street trees in the District each year from October through April. In addition, The UFA prunes14,000-17,000 street trees in the District each year. With the District's street tree population estimated at 100,000 trees total, this pruning volume allows the UFA to maintain a five-to-seven year pruning cycle, which is a recommended industry standard. The purpose of these pruning efforts is to maintain the tree's overall health and form, and the safety of the area around the tree.

DC DOH also contributes to District tree planting efforts. As part of its WIPs, DC DOH works to expand the overall width and enhance the buffering capacity of the District's riparian corridors (see RFB above) and identifies opportunities to plant trees in the watershed. In cooperation with the DC Department of Parks and Recreation (DC DPR), new models for quality reforestation are considered, not only in stream riparian zones, but also throughout watersheds. While these new models are more effective, the traditional method of planting singularly placed and cared for trees and shrubs can dramatically increase shading and carbon dioxide uptake. Usually once or twice a year, DC DOH/WPD organizes buffer planting events in target watersheds, involving the public and local non-profits.

The District of Columbia, through its various agencies involved in forestry activities, looks for opportunities where volunteers can work with the city to plant trees on public lands. These projects not only help to involve citizens in the restoration and protection of the city tree canopy, but they also teach environmental stewardship. Funding for these activities comes from small grants through the City Forester and the U.S. Forest Service and the Casey Trees Endowment. Projects range from a Community Tree Planting program where Casey Trees Endowment joins with civic groups to plant and care for trees in their neighborhoods to projects where school teachers engage their students in the planting and care of trees on their school property. In addition, DC DOH, with the help of Casey Trees Foundation, has made tree planting an important component of its schoolyard conversation program.

<u>Recommendation</u>

- The practice of planting trees on urban land is not an accepted BMP under the Chesapeake Bay watershed model. However, the Chesapeake Bay Program has recognized through its Forest Buffer Directive (December 2003) the importance of the urban tree canopy in overall health of the Bay watershed. Although the District cannot currently receive numerical load reduction credits for tree planting for, tree planting should be encouraged because of its many environmental benefits.

c. Wetland Restoration

Description

Wetland restoration is the creation or enhancement of wetlands in areas where wetlands used to exist. It is an important BMP because of its effectiveness in trapping sediments and removing nitrogen. Wetlands are of great ecological value to any watershed. There are many types of wetlands. Of these, tidal and nontidal marshes are especially important to the District's restoration program.

The Anacostia River has been the focus of significant tidal marsh restoration work and planning for over a decade. In 1993, the mudflats in Kenilworth Marsh were converted into vegetated emergent tidal wetlands using material dredged from the river's channel. An interagency effort, the restoration was conceived and initiated by the US Army Corps of Engineers with guidance from the District government, the US National Park Service and others. In the end, over 33 acres of marsh were restored.

The success of the Kenilworth Marsh restoration project spurred the District's second created wetland attempt along the Anacostia River. In 2000, 40 acres of freshwater tidal wetlands were created in the Kingman Lake braid of the Anacostia. At the time, the completion of this project almost doubled the acreage of tidal wetlands on the Anacostia River and in the District. Finally, in summer 2003, two Anacostia River "fringe" wetlands, located just north and south and of the E. Capitol Street Bridge, were completed with the help of the US Army Corps of Engineers.

Recent District of Columbia wetland restoration efforts have coincided with the development of a DC Wetland Conservation Plan (1997). This plan has aided wetland conservation in the District by:

- Examining the current state of the District's wetlands and potential and ongoing impacts to these resources.
- Outlining a comprehensive strategy to mitigate wetland impacts.
- Presenting a regulatory approach to protect, restore, and enhance wetlands within the District.
- Integrating various federal, regional, and local wetland protection programs to provide a more comprehensive strategy and to maximize the effectiveness of existing wetland programs with respect to regulatory oversight, mapping and monitoring, restoration, acquisition, incentives and disincentives, public outreach and research.

In accordance with these guidelines, the DC government continues to seek areas for wetland restoration, as well as the funding to conduct this work. The District is dedicated to increasing wetlands for the nutrient filtering capacity these wetlands provide and the District's relationship to the Chesapeake Bay.

Recommendations

- Complete the planned 8-acre wetland creation work proposed in the District's Kingman and Heritage Island Restoration Project.

- Continue to monitor the fringe wetland project on Anacostia to insure proper establishment.

d. Stream Restoration

Description

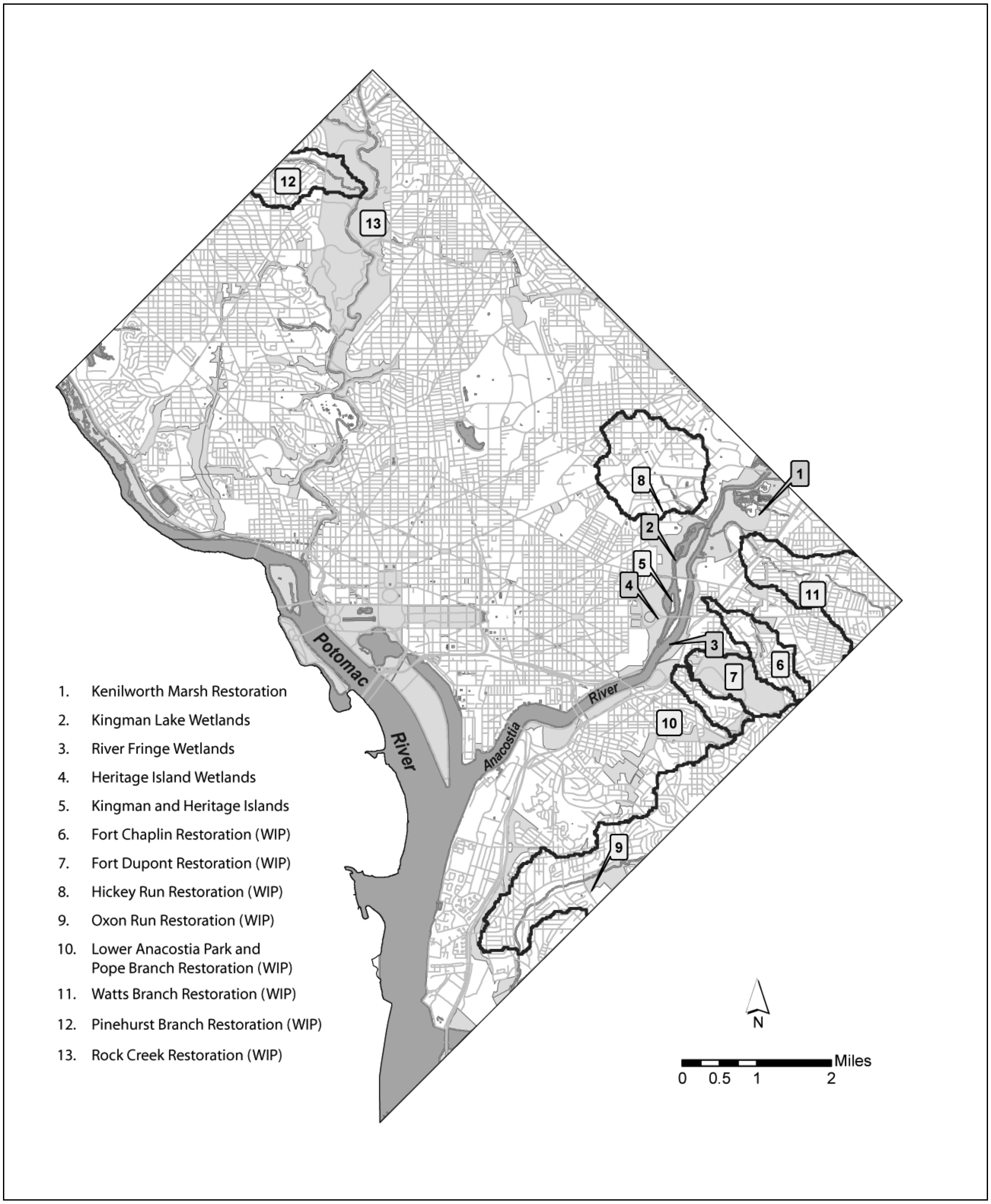
Streams, particularly in suburban and urban areas, have become severely degraded from land activities associated with development. The associated loss of perviousness has changed the hydrology of the watershed dramatically, increasing stream flows during wet weather. This has resulted in flashier flows with increased stream bank erosion, increased sediment load, and loss of vegetation and shade. Increased stormwater flows also have led to degraded water quality from nonpoint source pollution. Stream restoration practices address excessive erosion, sediment, and nutrient levels in the stream. In urban areas, where a primary cause of these problems is the contribution of flashy stormwater inputs, stream restoration can take the form of onsite stormwater management and LID that retain stormwater runoff. Urban areas can also employ conventional practices such as natural channel restoration, which involves the re-creation of a stream's floodplain, and stream bank stabilization, which involves the stabilization of eroding banks through hard or soft (bioengineered) methods.

As the District's most polluted waterway, the long-neglected Anacostia River—including her tributaries—recently has become the focus of a long-awaited watershed restoration initiative. Due to funding limitations, the District of Columbia has developed a targeted watershed approach for restoring the Anacostia River, as outlined in the *Anacostia Watershed Restoration Action Strategy* (1999). This approach involves identifying smaller, more manageable projects in the river and its tributary streams, and implementing these projects as funds become available. Figure 9 displays restoration project sites in the Anacostia watershed.

Unlike other jurisdictions signatory to the Chesapeake Bay Agreement, the District of Columbia produces its own locally supported watershed management plans, rather leaving the creation of these plans up to non-governmental organizations. The DC DOH currently is in the process of updating its WIPs for the Watts Branch, Fort Chaplin, Fort Dupont, Hickey Run and Oxen Run tributaries. Furthermore, the District is planning to create a first-ever WIP for Rock Creek in 2004.

The restoration strategies found in these WIPs have several components summarized below.

FIGURE 9: WATERSHED PROJECTS IN THE DISTRICT OF COLUMBIA



Stormwater Runoff Reduction Strategy: Work with DC government agencies, local organizations, and citizens located within the Pope Branch watershed to reduce the volume and improve the quality of stormwater flowing into streams through encouraging the use of BMPs and LID design.

Stream Restoration Strategy: Reduce nonpoint source loads through redesigning stream channels using natural channel design. Design will address the issues of stormwater runoff and the resulting accelerated land and stream bank erosion, and work to restore bank integrity, water quality and habitat quality. If necessary, realign existing sewer lines as part of the stream channel redesign to ensure that the line is no longer compromised by natural stream meandering. Expand riparian forest buffer and protect the existing buffer from the effects of invasive species.

Targeted Community Outreach and Development of Community Watershed Stewards Strategy: Promote citizen involvement in restoration to help provide for the long-term protection of streams' natural resources. To ensure relevance of outreach programs and other watershed activities, conduct a yearly assessment of WIP implementation strategy and use adaptive management to update and revise management strategies, if necessary.

Institutional change and regulatory changes: Strengthening of the legal requirements for stormwater management for new projects. This would include retention of 50 percent of stormwater from impervious areas in the construction footprint. Develop a cost-sharing mechanism for LID projects that treat any excess amount (above 50 percent) that would be available to government and private development.

By implementing these goals, it is believed that, in addition to improving the watershed as a whole, significant enough water quality, habitat, and park improvements in the District's smaller neighborhood streams may be achieved so that they attain District of Columbia class B and class C designated use categories. The restoration goals of the District's watershed implementation plans are closely aligned with those of the *Chesapeake 2000 Agreement* and with local governmental and nongovernmental initiatives.

<u>Recommendations</u>

- Restore 5 miles of DC tributaries of the Anacostia (Pope 1.3 + Watts 2.6 + Hickey Run 1.0)
- Restore 2 miles of DC tributaries of the Potomac (Oxon Run)
- Stabilize 2 miles of DC tributaries of Rock Creek (Pinehurst 1.0 + Main Stem Rock Creek 1.0)
- Continue to work with urban stormwater workgroup to find nutrient and sediment reduction efficiencies for urban stream restoration activities.
- Work with our federal partners (USNPS, USFW, and USACOE) to complete the stream restoration projects identified in this strategy by 2010.

e. Marine Pumpouts

Description

The Clean Vessel Act (CVA) of 1992 authorized a competitive grant program for states to construct pumpout and dump stations to dispose of vessel sewage generated by recreational boaters. The DC Department of Health's Fisheries and Wildlife Division has participated in this program since 1995. High in nutrients, organic material and bacteria, raw or poorly treated sewage can cause excessive algal growth, lower oxygen levels in water, spread disease and contaminate shellfish.

The Fisheries and Wildlife Division has helped nine District marinas receive marine pumpout equipment through the CVA. Currently, 10 of the 13 total marinas located in the District (about 77 percent) are in voluntary compliance with the CVA's guidelines. These participants include all marinas located along the Anacostia River. Furthermore, the Fisheries and Wildlife Division is pleased to report documented heavy usage of the marine pumpout equipment at all nine marinas that received CVA funding. The pumpout stations are widely used by both District and visiting recreational boaters. DC DOH considers its marine pumpout program to be an important tool in its efforts to minimize nutrient pollution in its surface waters and the Chesapeake Bay.

Recommendation

- Given future funding under the CVA act, DC DOH will continue to seek 100 percent marine pumpout participation from District marinas. These sustained efforts should provide all of the District's recreational boaters with a feasible alternative to overboard disposal of vessel sewage.

f. Pollution Prevention

Description

In addition to the District's environmental restoration efforts, DC DOH is involved in a number of pollution prevention initiatives. These initiatives primarily employ citizen education as a means to show District residents how their actions affect their environment, and what they can do to minimize these effects. Although public education and pollution prevention are important components of the District's nonpoint source management program, no information is available to quantify the nutrient and sediment reductions they might achieve. An overview of each initiative is provided below.

1. Nutrient Management

DC DOH has tailored environmental education programs for groups other than children. Nutrient Management is a pollution prevention practice that is encouraged by the Nonpoint Source Management Program. This program targets homeowners, community gardeners, and others, who manage lawns, gardens, and open spaces, and furnishes them with information and technical support that they can use to help protect the environment.

Nutrient management is an ecological approach to lawn and garden care. It provides guidelines for the conservation of nutrients when maintaining lawns and gardens, especially in cases when fertilizers are used. While the nitrogen, phosphate and potash found in fertilizers promote plant growth, these nutrients also can pollute our surface and ground waters if not properly managed. DC DOH distributes brochures and offers further information on nutrient management through its Watershed Protection Division. This program can be an effective tool for minimizing nutrient inputs from lawns and gardens.

Another important component of nutrient management in urban areas is pet waste control. During rainfall, pet waste left on lawns, roads and sidewalks can wash into storm drains and local waterways. For both human health and environmental protection, pet owners must insure that pet waste is disposed of properly. It is the law in the District of Columbia. DC DOH provides information on proper pet litter control to District residents through fairs, the animal shelter and veterinarian offices.

2. Green Marinas

Marinas have the potential to contribute nonpoint source pollution to the Chesapeake Bay and its tributaries in a number of ways. Examples of these contributions include nutrients and pathogens from pet waste and overboard sewage discharge; sediments from parking lot runoff and shoreline erosion; petroleum hydrocarbons from fuel, oil and solvents; and toxic metals from anti-foulants (USEPA, 2001). To help control nonpoint source pollution from these unique sources, DC DOH has helped to implement a Green Marina Initiative in the District of Columbia. In brief, the Green Marina Initiative promotes voluntary adoption of measures to reduce waste and prevent pollution from marinas, boatyards and recreational boats.

The Green Marina Initiative is a partnership program with the National Park Service. This program establishes a broad public/private partnership dedicated to the restoration and environmental stewardship of the Anacostia and Potomac Rivers, and the Chesapeake Bay. The goal of the program is to motivate boating facilities to achieve the "Green Marina" status by voluntarily following the principals set forth in the *Green Marina Guidebook*. Participants begin the program by signing the Green Marina Pledge contained in the guidebook, thus demonstrating their commitment to compliance. Next, implementation of the guidebook's checklist requirements leads operators through the process of achieving Green Marina status. Green Marina checklist priorities include:

- Vessel maintenance and repair
- Petroleum storage and transfer
- Sewage disposal
- Hazardous and non-hazardous wastes
- Stormwater runoff
- Facilities management

Overall, the program emphasizes environmental compliance and going beyond compliance through the implementation of Best Management Practices (BMPs), keys to achieving the Green Marina status. The USEPA, the U.S. Coast Guard, the mayor of the District of Columbia, and the director of the NPS have signed on as partners to the program, and have pledged their support. Using Fish and Wildlife Service grant funds every marina in the District now has pumpout facilities. The NPS has banned "live aboard boats" from its leased marinas on the Anacostia River. These two measures have greatly reduced boat discharges of sewage.

3. Schoolyard Conservation

There is growing interest throughout the United States in reconnecting our children to the land. Many teachers and environmental educators have developed schoolyard conservation sites in response to this trend. In addition to putting students in touch with the natural environment, conservation sites enhance school properties, turning ordinary schoolyards into lush environments for hands-on learning.

Overall, DC DOH believes that the future restoration of the Chesapeake Bay depends on a knowledgeable and concerned citizenry, and that schoolyard conservation promotes this. When the District's youth to practice conservation on school grounds, they gain the opportunity to share these practices with their parents and to carry the lessons into their own adult lives. Creating wetlands, ponds and meadows, or planting trees, shrubs and gardens can add beauty and diversity to school grounds as an accompanying benefit to fostering ecological awareness and global thinking in those who participate. Using these sites as teaching tools, educators can help students implement conservation techniques to correct erosion problems, improve the water quality of a neighboring stream or river, provide or conserve wildlife habitats or address an environmental problem or concern in the community.

To encourage the development of conservation projects on school sites, DC DOH provides grant funds, technical assistance and resource materials to District schools. Students, teachers and the community learn to develop and maintain their sites in ways that protect the Anacostia and Potomac Rivers from nonpoint source pollution and contribute to the health of the land, air, and rivers that are tributary to the Chesapeake Bay.

Recommendations

- Involve citizens in government-led projects that reduce nutrients and sediments being delivered to the District waters and the Chesapeake Bay. Citizen participation will be crucial to project effectiveness. More importantly, citizens themselves can undertake activities that will make direct contributions towards the nutrient and sediment reduction goals.

- The District will continue to work with the Chesapeake Bay Program and its partners to promote the CBP media campaign and to include urban nutrient management messages in upcoming literature and media outreach efforts. The District also will support the work of the DC Soil and Water Conservation District to supply soil test kits to District homeowners and include literature on healthy soils and nutrient management as a part of ongoing tree planting, gardening, and conservation workshops. Lastly, the District will look to have 100 percent of its marinas reach "green marina" status.

g. Public Education and Outreach

Description

Citizens must be educated in the areas of environmental conservation, restoration and pollution prevention if nonpoint source pollution is to be minimized on a large scale. DC DOH's environmental education and outreach staff teaches environmental stewardship by helping District residents understand how their everyday actions affect the environment. Although DC DOH targets both young people and adults in its education efforts, District youth are the primary audience. The benefits of this strategy result not only from the fact that young people are still in the process of forming their belief and value systems, but also from the fact that children tend to have a profound influence on their parents' decisions, actions and habits. This influence is best demonstrated by the significant amounts of money that parents spend on items that are primarily marketed to children. DC DOH not only attempts to educate children directly, but also indirectly, by training their teachers. Teacher training helps to institutionalize and reinforce the importance of environmental learning, stewardship and conservation.

The following is list of some DC DOH environmental education programs and resources:

Anacostia River Environmental Fair
DOH organizes an annual outdoor fair in Anacostia Park to celebrate the Anacostia River as a vital natural resource, while educating students about pollution prevention and the impact of trash on the river.

Project Learning Tree, Project WET, Project WILD
DOH utilizes Project Learning Tree, Project Wet, and Project WILD (internationally recognized conservation education programs) to provide hands-on, multi-disciplinary training for teachers and community educators working with students in pre-K through grade 12.

Teacher Training Workshops
DOH offers workshops and training opportunities that assist District of Columbia schoolteachers in fulfilling the District's Standards for Teaching and Learning while helping students develop environmental ethics and responsible stewardship.

Environmental Education Resource Center
DOH has developed an environmental education resource center to act as a "one-stop-shop" for teachers and other environmental educators seeking high quality environmental education materials that promote interdisciplinary learning, reinforce science, math and reading skills, and adhere to national education standards. The center (located at 51 N Street, N.E., Room 5015) maintains a variety of curricula, audio-visual materials, kits, gardening tools, lab equipment, references, models, brochures, maps and posters. Educators may browse, borrow materials and take some free items.

Volunteer Action Stewardship Opportunities
DOH offers volunteer action stewardship opportunities such as tree plantings and stream cleanups to area school groups. These activities foster community stewardship and promote environmental awareness and responsible action. These activities can remove a source of pollution.

Recommendation

- The District will continue to work with various citizens groups to identify other activities and programs in which citizens can participate. Working with civic associations, advisory neighborhood commissions, the public school system and other citizens, the District will continue to undertake a strong educational program for public involvement. These public outreach efforts are also critical to the District's goal to clean up the Anacostia. The clean up will be successful only with increased public involvement and participation in restoration activities.

4. Chesapeake Bay Program 2007 Cap Reevaluation and the DC Tributary Strategy

As the Chesapeake Bay Program and partners were undertaking their strategy development process, it became clear that there were many ongoing concurrent activities that were not complete that could potentially affect nutrient and sediment reduction goals and strategies. First, Bay states and the District of Columbia are under a regulatory mandate to prepare Total Maximum Daily Loads (TMDLs) for many of the tributaries to the Bay. Regulations under the Clean Water Act require states to list any water body that shows impaired water quality and to determine the level of pollutant daily load that the water body can receive and still meet water quality standards. The impact of these TMDLs will need to be assessed in relation to calculated nutrient and sediment allocations. In addition, the Bay Program is upgrading its models, refining the Water Quality Model to better capture local water quality and sediment transport and refining the Watershed Model to incorporate more BMPs with better-documented efficiencies. Lastly, jurisdictions need to adopt proposed changes to state water quality standards.

As a result of the above activities, the Bay Program and Bay partners agreed to "complete a comprehensive evaluation to determine if any refinements are needed to nutrient and sediment loading reduction goals and strategies to ensure the Bay and its tidal rivers can be delisted by 2010" (CBP 1999). The District is scheduled to complete TMDL development for all of its tributaries on its 303(d) list by September 2007. TMDLs were completed for the Anacostia and its tributaries in 2003 and Rock Creek was completed in 2004. In turn, the State of Maryland TMDL for the Middle Potomac is scheduled for 2008. At the same time, the District of Columbia is working with Potomac stakeholders and the USACOE to better model the water quality of the Mid-Potomac as a TMDL effort.

The improvements to the Potomac model will focus upon the interactions between sediment transport and nutrients. Better resolution of the fate of dissolved versus particulate phosphorous will help clarify some of the questions surrounding nutrient equivalents in the Potomac basin. The Potomac has a long history of microcystis algae blooms that create elevations of pH and enhanced sediment phosphorous fluxes. These peculiarities will be incorporated into the Potomac TMDL calculations. Efforts are underway to improve the quantitative understanding of the water quality effects of depleted living resources such as oysters and menhaden. Virginia and Maryland are developing more accurate information on shoreline erosion rates and this model will have more complex relationships to better characterize cause and effects.

The nutrient and sediment allocations to achieve Maryland water quality standards represent a voluntary agreement. A TMDL on the Potomac will be a regulatory activity which demonstrates that a source “causes or contributes to a violation of the WQS;” such a demonstration may result in regulatory actions if a point source such as Blue Plains is demonstrated to “cause or contribute” to this violation. The current Chesapeake Bay model does not at this time contain enough mechanisms to determine the full range of causative factors for the water quality problems in the mainstem Bay.

The Cap Reevaluation proposed for 2007 will give jurisdictions the opportunity to assess progress and provide an opportunity to adjust tributary strategy implementation plans and schedules based on more refined models and prepared TMDLs. At that time, the District of Columbia will examine its nutrient and sediment load allocations in relation to model upgrades and statutory requirements for TMDLs and make adjustments to its strategy where necessary.

C. Estimated Source Load Reductions, Cost Estimates and Tracking Reductions

1. Estimated Source Load Reductions

Relatively simple techniques are used in this strategy to characterize the load reduction from individual strategy elements and to assess the overall strategy effectiveness with respect to cap-load allocation goals. The individual strategy elements involved in the calculation are urban BMPs, wetland restoration, stream restoration, CSOs, Washington Aqueduct, Blue Plains WWTP and the nitrogen equivalent credit. Load reductions from each strategy element are deducted from the modeled 1985 Base load and the result is compared to the cap-load allocation. Table 6A shows each strategy element, its associated load reduction and the resulting year 2010 projected loads. Appendix C provides a detailed method description that may be used to reproduce the calculations used in this strategy.

TABLE 6A: ESTIMATED LOAD REDUCTIONS FOR TOTAL NITROGEN, TOTAL PHOSPHORUS, AND SEDIMENT BY MAJOR STRATEGY ELEMENT

Model Scenario	**TN [lbs/yr]**	**TP [lbs/yr]**	**TSS [tons/yr]**
Model 1985 Base Load	8317407	160321	5808
Strategy Elements			
NPS Reduction [Urban BMP Inside CSO]	0	0	0
NPS Reduction [Urban BMP Outside CSO]	789755	156458	138491
NPS Reduction [Wetland restoration]	1569	174	43
NPS Reduction [Stream restoration]	1103	193	70
PS Reduction [CSO improvements]	143680	40933	2
PS Reduction [Blue Plains]	4200123	0	0
PS Reduction [WADCOE]	3370	2724	754
Total Strategy Reductions	*5139601*	*200482*	*139360*
Nutrient Equivalents			
Equivalent Reduction (1)	2946248		

Projected 2010 Load (2)	**TN [M-lbs/yr]**	**TP [M-lbs/yr]**	**TSS [M-tons/yr]**
Total, With Equivalents	*0.23*	*0.00*	*0.00*

Footnotes:

1. The equivalent reduction is a TN credit claimed for surplus reduction below the TP cap-load.
   Equivalent Reduction = (TP[cap] - TP[load 2010]) * RR,
   where RR is a RedfieldRatio of 7.75 N:P.
   Final Nutrient Equivalent values will be based on 2007 Potomac TMDL Model recalibration.
2. The projected 2010 load equals the 1985 base load less the claimed reductions.

Source: DC DOH, Watershed Protection Division

TABLE 6B: DISTRICT OF COLUMBIA CAP LOAD ALLOCATION

District of Columbia Cap-load Allocation	**TN (M-lbs/yr)**	**TP (M-lbs/yr)**	**TSS (M-tons/yr)**
Cap-load	2.4	0.34	0.006

Source: Chesapeake Bay Program

2. Cost Estimates

a. Point Source (Blue Plains)

The costs to achieve Blue Plains Tier II loads as estimated by WASA represent total capital costs of $63 million dollars with annual operations and maintenance costs of $9.40 million dollars.

b. Combined Sewer Overflow (CSO)

The CSO total capital and annual O&M costs are taken directly from the Long Term Control Plan (LTCP) document and are detailed therein. The table below provides the cost opinion estimates for the various components in the LTCP with a total estimated capital cost of over $1.2 billion dollars. In addition, annual operation and maintenance costs are expected to be more than $13 million dollars.

TABLE 7: BLUE PLAINS COST ESTIMATE OPTIONS

TIERS	**Nutrient Concentration Assumptions** (1) (annual average)		**Updated Total Capital Costs** (2) & (4) & (5) ($ Millions)	**Updated Annual O&M Costs** (4) & (6) ($ Millions)
	TN	**TP**	**Total**	**Total**
Tier 1	7.5 mg/l	0.18 mg/l	$0	$0
Tier 2 (3)	7.5 mg/l	0.18 mg/l	$63	$9.40
Tier 3	5.0 mg/l	0.18 mg/l	$364	$13.40
Tier 4	3.0 mg/l	0.10 mg/l	$850	$19.40

Footnotes:

1. Reflects CBP definitions for Blue Plains WWTP concentrations in the Year 2010 – assuming no new or additional nutrient reduction requirements.
2. CBP definition of cumulative cost is reflective of incremental implementation of the Tiers; however, the derivation of the updated capital and O&M costs provided for this analysis present Tier costs as total costs for implementing each Tier from the status quo (i.e., assumed to be Tier 1). Assumptions are projected for conditions in the Year 2010. Costs presented are <u>not</u> escalated. See (7) below.
3. <u>Tier 2</u> capital costs and O&M costs have been <u>updated since the 4/02/02 submission</u> to avoid "de-rating" plant capacity and to address the new permit. An additional $30M in TN capital costs and an additional $0.5M in TN O&M costs have been included in the Tier 2 costs to specifically address treatment of increased digester recycle flows.
4. Updated costs for Tiers 3 & 4 have been revised to reflect: new phosphorus permit limit; revised capital costs that avoid "de-rating" of Blue Plains' design capacity & related permit flow requirements (see item 6d below for details); and the accurate portrayal of cumulative vs. incremental costs. [Note: This also includes corrections made to the TN-related and Total <u>Incremental</u> Capital Costs that were presented in the 5/30/03 submittal; as well as adjustments made to reflect updates made to the TP-related Capital Costs originally presented in the 2/1/04 update.]
5. All capital costs are preliminary planning level estimates with an accuracy of +50% / -30% (per standard engineering methods); also include 30% engineering & related administrative costs – which is consistent with the CBP's capital costing method. This methodology is also consistent with all of DC-WASA's other planning level efforts. Cost figures are in Year 2002 $'s.
6. O&M cost components include: biosolids handling, power, chemicals, operations-related labor, maintenance-related labor, and a maintenance parts allowance.

Source: DC-WASA

TABLE 8: COST ESTIMATES FOR INDIVIDUAL LTCP COMPONENTS

Component	Capital Cost ($ Millions)	Annual O&M ($ Millions)
System Wide		
Low Impact Development – Retrofit (LID-R)	$3	$0.11
Anacostia River		
Rehabilitate Pumping Stations	$115	$0
Storage Tunnel from Poplar Point to Northeast Boundary Outfall	$332	
Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer	$452	$7.98
Outfall Consolidation	$27	$0
Separate CSO 006	$3	$0.01
Ft Stanton Interceptor	$11	$0.04
Rock Creek		
Separate Luzon Valley	Completed	$0
Separation	$5	$0.02
Monitoring at CSO 033, 036, 047 and 057	$3	$0.01
Storage Tunnel for Piney Branch (CSO 049)	$42	$0.60
Potomac River		
Rehabilitate Potomac Pumping Station	$12	$0
Outfall Consolidation	$20	$0
Potomac Storage Tunnel	$218	$2.78
Blue Plains Wastewater Treatment Plant		
Excess Flow Treatment Improvements	$22	$1.81
Grand Total	*$1,265*	*$13.36*

Source: Combined Sewer System Long Term Control Plan, Final Report, July 2002

c. Nonpoint Source

Nonpoint source implementation costs are shown in tables 10A, 10B and 10C represent three cost scenarios: the cost for existing BMP installations outside the CSO (10A), the cost to continue BMP installation at current rates outside the CSO (10B), and the cost to fully implement BMPs outside the CSO (10C).

The scenario shown in table 10B depicts the cost of future urban BMP installations if the rate of installation were to continue at present levels. This scenario contains two assumptions: 1) that BMP installation will continue at the same rate as during the 5-year period from 1998-2002, and 2) that future BMPs of various types will continue to be installed in the same relative proportions as during the 1998-2002 period.

Table 10C shows another scenario whereby all District land area outside the CSO will be retrofitted. The costs projected here assume: 1) full implementation in land areas outside of the CSO not currently served by BMPs and 2) that future BMPs of various types will be installed on that area in the same relative proportions as during the 1998-2002 period.

Future stream restoration BMP cost is calculated based on the sum of projected project construction costs for the individual restorations. The total capital cost for non-point source reduction projects in areas outside the CSO will likely top $31 million dollars if we continue at the same rate. In order to meet MS4 requirements

TABLE 9: AREA OUTSIDE THE CSO AVAILABLE FOR TREATMENT

Area	Acres
Sum of WSM 4.3 Model Segment Areas in DC	39386
CSO Area	12951
2002 BMP Service Area Outside CSO	456
Available Service Area Outside CSO	**25979**

Source: DC DOH, Watershed Protection Division

TABLE 10A: COST OF BMP IMPLEMENTATION OUTSIDE THE CSO TO DATE (1987-2002)

BMP Options	1987-2002 Area acres (1)	Capital Cost $/acre (2)	Capital Cost	O&M Cost $/acre/yr (3)	O&M Cost $/yr
A. Wet ponds and wetlands	83.6	146,000	12,199,758	157	13,119
B. Dry detention, hydrodynamic structures	108.1	42,000	4,540,725	NA	NA
C. Dry extended detention ponds	2.0	157,500	315,000	87	174
D. Infiltration practices	25.1	37,000	929,109	494	12,405
E. Filtering practices	237.0	58,250	13,806,432	714	169,232
Total Cost	**456 Total Acres**		**31,791,024**		**194,930**

TABLE 10B: COST OF BMP IMPLEMENTATION OUTSIDE THE CSO AT CURRENT RATES (2002-2010)

BMP Options	Future Area acres or feet (1)	Capital Cost $/acre or $/ft (2)	Capital Cost	O&M Cost $/acre/yr (3)	O&M Cost $/yr
A. Wet ponds and wetlands	1.7	146,000	254,622	157	274
B. Dry detention, hydrodynamic structures	170.3	42,000	7,152,417	NA	NA
C. Dry extended detention ponds	0.0	157,500	0	87	0
D. Infiltration practices	25.9	37,000	957,204	494	12,780
E. Filtering practices	183.4	58,250	10,682,999	714	130,947
F. Stream Restoration (feet)	55,140	224	12,351,360	NA	NA
Total Cost			**31,398,602**		**144,001**

TABLE 10C: COST OF FULL BMP IMPLEMENTATION OUTSIDE THE CSO (2002-2010)

BMP Options	Future Area acres or feet (1)	Capital Cost $/acre or $/ft (2)	Capital Cost	O&M Cost $/acre/yr (3)	O&M Cost $/yr
A. Wet ponds and wetlands	119.0	146,000	17,380,589	157	18,690
B. Dry detention, hydrodynamic structures	11,624.4	42,000	488,226,829	NA	NA
C. Dry extended detention ponds	0.0	157,500	0	87	0
D. Infiltration practices	1,765.9	37,000	65,339,119	494	872,366
E. Filtering practices	12,518.9	58,250	729,225,717	714	8,938,492
F. Stream Restoration (feet)	55,140	224	12,351,360	NA	NA
Total Cost			**1,312,523,613**		**9,829,548**

Footnotes:

1. Area in acres outside the CSO to be serviced by each practice; in order to estimate future implementation the DC land area outside the CSO that is not currently served is multiplied by the relative percent area for each practice. Relative percent area served is based on the period 1998-2002.
2. Per-acre capital costs of the various urban BMP types are typical of projects in the District of Columbia and were determined based on communication with contractors
3. Estimated Costs to Attain Chesapeake Bay Water Quality Standards: Storm Water BMPs, 2004, Chesapeake Bay Program Office, Urban Stormwater Workgroup, Annapolis, Maryland

Source: DC DOH, Watershed Protection Division *d. Cost Summary*

In order to implement this tributary strategy we expect that capital costs will exceed $4.2 billion dollars and in order to maintain the strategy will require over $24 million annually thereafter.

TABLE 11: COST SUMMARY

Cost Category	Capital Cost $ Billions	Annual O&M $ Millions
Capitol Budget for Blue Plains WWTP (1)	1.6	9
Implementation of CSO Long-Term Control Plan (2)	1.3	13
Implementation of Urban BMPs (required under MS4 Permit) (3)	1.3	10
Removal of sediment from Washington Aquaduct effluent (4)	0.1	
Total	**4.2**	**24**

Footnotes:

1. Capitol Improvement Plan
2. Combined Sewer System Long Term Control Plan, Final Report, July 2002
3. This document, tables 10A, 10B AND 10C
4. Washington Aquaduct, Corps of Engineers

3. Tracking Load Reductions

The District of Columbia will continue to track progress towards meeting nutrient and sediment reduction goals. Tracking of BMP implementation levels involves data gathering followed by data processing in order to compose a submission in a format that is acceptable to the Chesapeake Bay Program. The data comes from a variety of sources within Watershed Protection Division as well as from Tributary Strategy stakeholders.

The BMP categories represented in The District of Columbia, and tracked by Watershed Protection Division, are urban stormwater control and restoration. Washington Aqueduct is managed by Army Corps of Engineers and information on reduction progress associated with Aqueduct improvements is obtained from regular discharge reports required under the discharge permit. Nutrient reductions associated with CSO Long Term Control Plan implementation will be tracked by DC WASA studies.

Future versions of the Watershed Model hopefully will account for other practices that are typical of urban environments. Street sweeping, trash pick-up and catch basin cleaning are tracked by DC DPW and are reported in the MS4 Annual Report. LID is another possible candidate and Watershed Protection Division is responsible for several LID projects already.

Watershed Protection Division will continue to work with stakeholders in order to gather the tracking data required by the Chesapeake Bay Program.

TABLE 12: SOURCES OF TRIBUTARY STRATEGY ACTIVITIES TRACKING DATA

Data Type	Included in WSM 4.3	Source	Format
Urban Stormwater BMPs	Y	DC DOH, Watershed Protection Division	Microsoft Access database
Restoration Projects	Y	DC DOH, Watershed Protection Division	Microsoft Access database
LID	N	DC DOH, Watershed Protection Division	Microsoft Access database
Washington Aqueduct	N	Army Corps of Engineers	Discharge reports forms, Microsoft Excel table
CSO	Y	DC WASA	N/A or internal to DC WASA
Blue Plains WWTP	Y	DC WASA	N/A or internal to DC WASA
Street sweeping, trash pick-up, catch basin cleaning	N	DC DPW	MS4 Annual Report

Source: DC DOH, Watershed Protection Division

D. Implementation Schedule

Table 13 below provides a schedule and timeline of completed and proposed implementation of the major components of the District's Tributary Strategy. The District of Columbia has undertaken a multi-faceted approach to control pollutants, including nutrients and sediment, in order to improve the water quality of its surface waters. DC WASA has proposed an extensive series of infrastructure improvements under the LTCP to control the District's number one cause of water quality impairment, combined sewer overflows. As part of its storm water management program, the District has reviewed and assessed the needs and costs to retrofit the entire city with storm water controls. Local TMDLs will require DC to retrofit the city. Lastly, DC WASA is exploring various efficiencies to maintain Blue Plains at 7.5 mg/L annually.

It is important to realize that at the present time the implementation of the proposed schedule is dependent on several factors. First, there are legal issues still to be resolved with respect to finalizing the LTCP. Second, the availability and amount of financial resources needed to implement the LTCP, enhance Blue Plains nutrient removal capacity, and retrofit the city for storm water controls is enormous and too large to place on the backs of the citizens of the District of Columbia. Therefore, alternative sources of funding need to be found. Lastly, the District views its commitment to the Chesapeake Bay Program nutrient reduction goals in the same context of implementing required TMDLs. To that end the District will continue to aggressively pursue resolving these issues and working with Chesapeake Bay partners to find the necessary financial resources to both restore the water quality of District waters and the Chesapeake Bay.

TABLE 13: TRIBUTARY STRATEGY IMPLEMENTATION SCHEDULE

Year	CSO/LTCP	NPS	Blue Plains	Other
1993		Kenilworth Marsh restoration completed NPS Managed acres: 29.7 new acres 136.5 total acres	P=0.11 mg/L N=	
1994		NPS managed acres: 51.3 new acres 187.8 total acres	P=0.11 mg/L N=	
1995		NPS managed acres: 67.6 new acres 255.4 total acres	P=0.11 mg/L N=	
1996		NPS managed acres: 38.0 new acres 293.4 total acres	DC WASA established P=0.11 mg/L N=	
1997		NPS managed acres: 161.3 new acres 454.7 total acres	BNR project pilot begins P=0.11 mg/L N=	
1998		NPS managed acres: 69.0 new acres 523.8 total acres	P=0.11 mg/L N=	
1999		NPS managed acres: 66.7 new acres 590.5 total acres	P=0.11 mg/L N=	
2000		Kingman Lake wetlands completed NPS managed acres: 34.8 new acres 625.3 total acres	BNR project expands to full plant; nitrogen reduction of 55 percent. P ≤0.11 mg/L N ≤8 mg/L	Chesapeake 2000 Agreement
2001	Completion of CSO Long Term Control Plan	NPS managed acres: 32.6 new acres 657.9 total acres	Chlorine and sulfur dioxide use ends. Maintain BNR: P ≤0.11 mg/L N ≤8 mg/L	
2002	Release of CSO Long Term Control Plan	NPS managed acres: 35.1 new acres 693.0 total acres	Maintain BNR: P ≤0.11 mg/L N ≤8 mg/L	
2003		Anacostia River fringe wetland completed	Maintain BNR: P ≤0.11 mg/L N ≤8 mg/L	
2004		Heritage Island wetlands construction.	Maintain BNR:	Rock Creek fish passage barriers

		Over 700 acres in DC under BMP.	P ≤0.11 mg/L N ≤8 mg/L	removed.
2005		Watts Branch stream restoration (planned). Poplar Point rehabilitation.	Investigate operational controls for improving BNR.	
2006		Pope Branch stream restoration (planned)	Test operational controls for improving BNR.	
2007			Allocate WLA & LA with MOS to BPWWTP DC share & DC NPS.	Potomac TDML Chesapeake Bay allocation reevaluation. Investigate nitrogen equivalents with improved models.
2008			Blue Plains permit renewal process begins. Facility planning and design to meet DC share of BPWWTP allocation if necessary.	Determine nutrient trading and equivalents for cost-effective allocation of DC share of BPWWTP allocation.
2009			Complete design and initiate construction to achieve DC share of allocation to BPWWTP if necessary.	Evaluate improvements to water quality in Anacostia from upstream sources. Determine progress in achieving WQS in Bay.
2010	CSO pump station rehabs. complete. CSO tunnel construction begins.		Complete construction and initiate operation to achieve DC share of allocation to BPWWTP if necessary.	Chesapeake Bay TMDL (if necessary)

Source: DC DOH, Watershed Protection Division

E. Conclusion

The Chesapeake Bay is impaired for dissolved oxygen. It suffers from poor water quality primarily as the result of large inputs of nutrients and sediment from agricultural runoff. Wastewater treatment plants, urban runoff and forests also contribute, but to a lesser degree. The District of Columbia is located in the Potomac basin, and so has only one tributary allocation. The District's cap allocation is 2.4 million pounds of nitrogen and 0.34 million pounds of phosphorus, and 6,000 tons of sediment per year. Agricultural nonpoint source pollution from upstream sources impacts the Potomac River. This is in stark contrast to District of Columbia Potomac waters, where CSOs have the largest impact on water quality.

The District of Columbia strategy to help meet the Chesapeake Bay Agreement nutrient and sediment reduction goals includes the following major elements:

Element 1: DC WASA will implement all components of the LTCP and aggressively seek federal funding to shorten the construction timeline as much as possible.

Element 2: At the Blue Plains WWTP continue to use BNR as a nitrogen reduction strategy and strive to achieve at least an annual average total nitrogen concentration in its effluent of 7.5 mg/L for the District's share of the flow and begin to optimize nitrogen removal voluntarily as technically feasible and cost effective. Optimization should be performed to determine the minimum levels achievable on an annual average with the current process trains.

Element 3: The Washington Aqueduct will implement its new NPDES permit requiring the treatment plant to remove at least 85 percent of the incoming sediment from its treatment train and not return that sediment to the river.

Element 4: Continue current programs to reduce nonpoint source pollution to Rock Creek, and the Anacostia and Potomac Rivers and fulfill MS4 permit requirements. This includes implementing a strong regulatory program to install best management practices (BMPs) to control stormwater, sediment and erosion for new construction; converting a large number catch basins per year; financially supporting the installation of LID on public facilities; and developing a comprehensive strategy to retrofit the entire city outside of the CSO area.

Element 5: Incorporate watershed management plans for Fort Dupont, Pope Branch, Watts Branch, Hickey Run and Kingman Island into tributary strategy implementation. These plans include wetland creation, stream habitat restoration, RFB creation, tree planting and LID installation designed to reduce the impacts from stormwater runoff from impervious areas.

Element 6: Continue to support public education and pollution prevention programs to reduce nonpoint source pollution from nutrients and sediments, even though the pollutant load reduction benefits cannot be quantified at this time.

Element 7: Through the strategies described above, continue to reduce phosphorus loadings to below 0.34 million pounds per year, encouraging nutrient exchange and trading to achieve the nitrogen allocation.

Element 8: Maintain progress in the restoration of the Anacostia River. The District of Columbia has established TMDL for biochemical oxygen demand, total suspended solids, bacteria and toxics. These TMDL establish the reductions necessary from District sources and Maryland sources to achieve water quality standards and restore the Anacostia River. The majority of pollution loads to the Anacostia River originate upstream in Maryland.

The District of Columbia remains committed to helping with the effort to clean up the Bay. However, with limited resources, the first priority of the District is to its local waters. To that end, the District of Columbia Strategy strongly recommends the full implementation of the District's Long Term Control Plan as its top priority and the retrofitting of the non-CSO area for stormwater management. This plan is not a stagnant document. The District of Columbia will continue to revise strategy implementation in response to new technologies, TMDL development, new funding sources and the outcomes from the 2007 reevaluation.

Funding now is the biggest challenge. The District of Columbia cannot implement this strategy at present funding levels. Therefore, the city and interested stakeholders must continue to explore various funding options. This includes seeking out more federal funding where possible, first for the city's LTCP and then for Blue Plains WWTP upgrades.

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APPENDIX A

ADDITIONAL INFORMATION

For More Information about water quality in the District of Columbia, about the Chesapeake Bay Program, and about the District's programs for reducing pollution, contact:

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Department of Health
District of Columbia Government
825 North Capitol Street, NE
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Phone: (202) 442-8982

Publications available from the DC Department of Health, Environmental Health Administration (address above)

< *Initial Public Comments for the District of Columbia's Re-evaluation of the Tributary Strategy*, a report on the initial public meetings to discuss the nutrient reduction strategy.

< *The 2004 District of Columbia Water Quality Assessment*, the District's biennial report on the status of water quality.

< *The District of Columbia Nonpoint Management Plan II.* 1999, describes the Districts plan for controlling nonpoint source pollution.

< *Erosion & Sediment Control Handbook*, intended to aid the general public and industry comply with DC erosion and sediment control regulations.

< *Stormwater Management Guidebook*, describes requirements of the District's Stormwater Management regulations.

APPENDIX B

PROCEDURES USED TO CALCULATE NUTRIENT AND SEDIMENT LOADS

The load estimates for District of Columbia are calculated here using relatively simple techniques. The efforts to improve District water quality and reduce loads focus on urban best management practices, wetland restoration, stream restoration and infrastructure improvements. Infrastructure improvements include those at Blue Plains Wastewater Treatment Plant, Washington Aqueduct and improvements to the District CSO.

Year 2010 treatment loads for each type of improvement have been calculated. Bay Program efficiencies are applied to each of these loads in order to obtain a load reduction estimate.

These load reductions, when subtracted from the District 1985 Base model scenario load, provide an estimate of District 2010 loads to the Chesapeake Bay. The 2010 load estimates are compared to the Districts cap-load allocation and indicate whether we will meet our responsibilities under the Bay Program agreement.

A. Urban BMP

1. Load calculation [$Load_{BMP2010}$]

The District urban BMP implementation levels are categorized by Bay Program practice category and their situation inside or outside the CSO. BMPs located within the CSO do not contribute to load reductions since stormwater falling within the CSO is treated by Blue Plains except in times of overflow.

Urban BMP 2010 implementation levels represent values extrapolated from 2002 levels based on a 5-year average annual implementation rate.

Loads from treated areas for each practice category are calculated using the following formula:

$$Load_{BMP2010} = A \times R_f \times R_v \times C \times K$$

Where:

A	Area in acres	
R_f	Annual rainfall in inches.	41
R_v	Annual average runoff-to-rainfall ratio, $Rv = 0.05 + (0.9 \times I_c)$ where: I_c is the percent imperviousness of the area A.	0.8825
C_N	Annual average N concentration in mg/L for heavy urban landuse.	14.38
C_P	Annual average P concentration in mg/L for heavy urban landuse.	1.86

C_{TSS}	Annual average TSS concentration in mg/L for heavy urban landuse.	54.15
K	Unit conversion factor	0.2266
I_c	Average percent impervious cover	0.925

2. Load reduction calculation [LoadReduction$_{BMP}$]

Reduction efficiencies, as determined by the Chesapeake Bay Program, are applied to each loading respective of its management practice type in order to obtain load reductions:

$$Load\,\mathrm{Re}\,duction_{BMP} = Load_{BMP2010} \times Efficiency$$

B. Stream Restorations

1. Loads

The Bay Program provides efficiency estimates for stream restoration in pounds of nutrient per foot restored and it is not necessary to know the stream loads to obtain a load reduction.

2. Load reduction calculation [LoadReduction$_{Streams}$]

Stream lengths to be restored were measured from District hydrographic map data. Reduction efficiencies, given in annual lbs/ft, were applied to these stream lengths to obtain a load reduction:

$$Load\,\mathrm{Re}\,duction_{Streams} = Length \times Efficiency$$

C. Wetland Restorations

1. Load calculation [Load$_{Wetlands}$]

Wetland areas to be restored were measured from District hydrographic map data. The water volume treated is calculated based on the assumption that the wetland area fills daily to an average maximum flooding depth of 18-inches.

Nutrient and sediment concentrations appropriate to Anacostia River water were used and are averages of available data in the Chesapeake Bay Program monitoring database [Stations KNG02 and ANA11].

Loads treated by each wetland were estimated using the following equation:

$$Load_{Wetlands} = A \times D \times C \times K \times 365$$

Where:

A	Area in acres at maximum flooding depth.	
D	Maximum flooding depth in inches.	18
C_N	Average N concentration in mg/L for Anacostia River water.	1.80
C_P	Average P concentration in mg/L for Anacostia River water.	0.12
C_{TSS}	Average TSS concentration in mg/L for Anacostia River water.	37.29
K	Unit conversion factor	0.002266

2. Load reduction calculation [LoadReduction$_{\mathbf{wetlands}}$]

Reduction efficiencies for wetlands, as determined by the Chesapeake Bay Program, are applied to each loading to obtain a load reduction estimate:

$$Load\,\mathrm{Re}\,duction_{Wetlands} = Load_{Wetlands} \times Efficiency$$

D. CSO Improvements

1. Load calculation [Load$_{\mathbf{CSO2010}}$]

In 1985 the CSO operated under what the Long Term Control Plan calls “No Phase I Controls.” The District submitted estimated CSO load data covering the years 1985-1996 to the Bay Program for incorporation into the Watershed Model 4.3 input.

The LTCP presents planned improvements as percent reduction of overflow volume, where the entire system will see a 99 percent reduction in overflow volume from the 1985 conditions.

The 2010 load estimate calculated here is:

$$Load_{CSO\,2010} = Load_{CSO1985} \times \frac{(100-99)}{100}$$

2. Load reduction calculation [LoadReduction$_{\mathbf{CSO}}$]

Load reduction due to CSO improvements can be calculated as:

$$Load\,\mathrm{Re}\,duction_{CSO} = Load_{CSO1985} - Load_{CSO2010}$$

E. Blue Plains Wastewater Treatment Plant

Source	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)
All Landuse	485667	54898	5808

Point Source	7831740	105423	0
Total	8317407	160321	5808

1a. Load calculation [$Load_{BP2010}$]

An estimate of 2010 loads from the Blue Plains Wastewater Treatment Plant is obtainable given the District share of IMA flow volume and the nutrient concentrations in the effluent.

The Blue Plains loading in 2010,

$$Load_{BP2010} = C \times V \times K \times 365$$

Where:

C	Concentration of nutrient in mg/L	
V	DC share of IMA flow in MG/day	152.5
K	Unit conversion factor	8.34

1b. Load calculation [$Load_{BP1985}$]

The Blue Plains loadings in 1985 can be obtained by subtracting the 1985 CSO load from the 1985 Base scenario point source load:

$$Load_{BP1985} = Load_{PS1985} - Load_{CSO1985}$$

Where:

$Load_{PS1985}$	CBP model 1985 Base scenario point source loading for District of Columbia.
$Load_{CSO1985}$	1985 CSO loading.

2. Load reduction calculation [$LoadReduction_{BP}$]

Load reductions due to Blue Plains improvements can be obtained:

$$LoadReduction_{BP} = Load_{BP1985} - Load_{BP2010}$$

F. Cap-Load Goal Assessment

1. Initial calculation

Having calculated reductions across the range of management practices, restoration activities and infrastructure improvements we can provide reasonable estimates of 2010 nutrient loads to the Bay. To do this we simply subtract all of our reductions from the DC share of the 1985 Base Load.

$Load_{1985\ Base}$

- Load Reduction $_{\text{BMP in CSO}}$
- Load Reduction $_{\text{BMP outside CSO}}$
- Load Reduction $_{\text{Streams}}$
- Load Reduction $_{\text{Wetlands}}$
- Load Reduction $_{\text{BP}}$
- Load Reduction $_{\text{WADCOE}}$
= Load $_{2010}$

DC will also claim nitrogen credits for phosphorous reduction below the cap load.

2. Credit calculation

This credit is based on a concept of nutrient equivalents. The Bay Program attempts to improve water quality by reducing the nutrients that lead to excessive growth of algal biomass. Excessive algae growth decreases water clarity and the reactions that occur upon death and decay of those organisms consume dissolved oxygen. The nitrogen and phosphorous ratio of plant biomass varies depending upon the type of plant; this N:P ratio is referred to as the Redfield Ratio. Algal biomass in the Bay – the thing to be reduced by way of limiting human activity and nutrient input to the bay – has an N:P ratio of 7.75:1.

A phosphorous-based nitrogen equivalent is:

$$N = P \times 7.75$$

A phosphorous-based nitrogen equivalent reduction credit is:

$$N_{Equiv.reduction} = \left(P_{CapLoad} - P_{Load\,2010}\right) \times N : P$$

This nitrogen credit is then subtracted from the 1985 Base Load, along with all other reductions in order to determine whether DC meets its cap-load allocation.

APPENDIX C

TRIBUTARY STRATEGY 2010 IMPLEMENTATION LEVEL PROJECTION NEEDED TO CALCULATE DISTRICT OF COLUMBIA NUTRIENT AND SEDIMENT LOADS

	Area in Acres by Segment					
BMP CATEGORY IN CSO	**220011001**	**540011001**	**890011001**	**910011001**	**Total Acres**	**Maintenance Frequency**
A. Wetponds and Wetlands		1.9	0.9		2.8	not available
B. Dry Detention Ponds and Hydrodynamic Structures		139.1	140.7		279.8	100% annual
C. Dry Extended Detention Ponds		0.0	0.0		0.0	100% annual
D. Infiltration Practices		10.2	8.4		18.6	100% annual
E. Filtering Practices		147.0	127.7		274.7	100% annual
F. Impervious Surface Reduction		0.1			0.1	
Street Sweeping and Catch Basin Inserts					0.0	
Erosion and Sediment Control		65.0	67.1		132.1	
Riparian Forest Buffers (Urban)					0.0	
Total Acres In CSO	0.0	363.3	344.8	0.0	**708.1**	

	Area in Acres by Segment					
BMP CATEGORY OUTSIDE CSO	**220011001**	**540011001**	**890011001**	**910011001**	**Total Acres**	**Maintenance Frequency**
A. Wetponds and Wetlands	10.3	89.1	73.5	25.9	198.8	not available
B. Dry Detention Ponds and Hydrodynamic Structures	600.2	5203.9	4291.9	1512.1	11608.2	100% annual
C. Dry Extended Detention Ponds	0.1	0.9	0.7	0.3	2.0	100% annual
D. Infiltration Practices	91.6	794.4	655.2	230.8	1772.1	100% annual
E. Filtering Practices	655.7	5684.7	4688.4	1651.8	12680.5	100% annual
F. Impervious Surface Reduction		0.0	0.1		0.1	
Street Sweeping and Catch Basin Inserts					0.0	
Erosion and Sediment Control	14.0	121.6	100.3	35.3	271.2	
Riparian Forest Buffers (Urban)		1.7			1.7	
Total Acres Outside CSO	1371.9	11896.3	9810.1	3456.3	**26534.6**	

	Length in Feet by Segment					
STREAM RESTORATION BMPS	**220011001**	**540011001**	**890011001**	**910011001**	**Total Feet**	**Maintenance Frequency**
G. Stream Restoration Inside CSO					0	
G. Stream Restoration Outside CSO		38565		16576	55140	
Total Feet	0	38565	0	16576	**55140**	

	Distance in Miles by Segment				
PRACTICES NOT MODELED	**220011001**	**540011001**	**890011001**	**910011001**	**Total Miles**
Street Sweeping Inside CSO		16367	16904		33271
Street Sweeping Outside CSO	3531	30615	25250	8896	68292
Total Miles	3531	46982	42153	8896	**101563**

POINT SOURCES	**TN**	**TP**	**TSS**	**Unit**	**Volume (mgd)**
Blue Plains WWTP	7.5	0.18	-	mg/L	152.5
CSO	5282	1147	170000	pounds/yr	
WADCOE	1444	1167	645975	pounds/yr	
NUTRIENT TRADING AND OTHER VARIABLES					
Nitrogen Equivalent Reduction (1)	2928508			pounds/yr	

Footnotes:

1. Final Nutrient Equivalent values will be based on 2007 Potomac TMDL Model recalibration